This document contains Appendix E from the 2004 Norwegian Star Data Report. Appendix E contains the sampling and analysis plan for Norwegian Star Sampling Episode 6504. The report and all the appendices for this sampling event can be downloaded from ***http://www.epa.gov/owow/oceans/cruise_ships/finalstar.html***

Norwegian Star

2004 Analytical Results

Appendix E

March 2006

Appendix E

SAMPLING AND ANALYSIS PLAN FOR NORWEGIAN STAR SAMPLING EPISODE 6504

United States
Environmental Protection
Agency

Sampling and Analysis Plan for Norwegian Star

Sampling Episode 6504
August 1-15, 2004

U.S. Environmental Protection Agency

Oceans and Coastal Protection Division
Office of Wetlands, Oceans, and Watersheds

Engineering and Analysis Division
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TABLE OF CONTENTS

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

This plan describes the on-board sampling and analysis activities to characterize graywater and blackwater generated and discharged by the cruise vessel Norwegian Star while in Alaska waters. This sampling program is being performed under the supervision of the Engineering and Analysis Division (EAD) and the Office of Wetlands, Oceans, and Watersheds (OWOW) of the U.S. Environmental Protection Agency (EPA).

This document presents information on the planned sampling episode. This document, in combination with the generic health and safety plan, is intended to serve as a guide to the field sampling crew, a review mechanism for EPA personnel, and a source of procedural information for vessel personnel. EPA personnel and supporting contractor performed an engineering ship visit to the Norwegian Star on May 18, 2004. This sampling plan was prepared based on the results from that ship visit and from subsequent follow-up communication with Norwegian Cruise Line personnel. Tables and figures are presented at the end of each section.

1.1 Background

EPA is currently conducting a data collection effort aimed at ultimately developing new wastewater discharge regulations for large cruise vessels (greater than 500 passengers) that discharge treated sewage (blackwater) or graywater in the waters of the Alexander Archipelago or the navigable waters of the United States within the State of Alaska or within the Kachemak Bay National Estuarine Research Reserve (hereafter referred to as Alaska waters). Such regulations are authorized by “Title XIV - Certain Alaskan Cruise Ship Operations” of the Miscellaneous Appropriations Bill (H.R. 5666) passed by Congress on December 21, 2000 in the Consolidated Appropriations Act of 2001 (Pub. L. 106-554)(Sections 1401 - 1414), also known as the Murkowski Bill. The law defines sewage to mean human body wastes and wastes from toilets and other receptacles intended to receive or retain body waste. Graywater means only galley, dishwasher, bath, and laundry wastewater; the term does not include other wastes or waste streams. Graywater and blackwater discharges to Alaska waters are also regulated by State law (AS 46-03.460 - 46.03.490).

The sampling program on board the Norwegian Star and the subsequent pollutant analyses, data analyses, and trip report preparation will focus on graywater and blackwater origins, intermediate stages of treatment, final treated effluent, and final discharges. EPA will use these data in evaluating pollutants in graywater and blackwater generated on board the Star, and determine the capability of the Star's wastewater treatment system to remove pollutants prior to discharge.

Graywater and flow characterization data are also important focuses of the Star sampling program, as available graywater and flow characterization data are very limited. Sample collection will be established to provide information regarding pollutant concentrations and loadings for individual graywater sources (e.g., galley, laundry) and will provide information to develop time-phased "flow profiles" for the sampled waste streams to analyze patterns and variability in graywater and blackwater flows both throughout the day (e.g., day versus night, mealtimes) and between days (e.g., while underway, in port).

1.2 Ship Selection

EPA selected the Norwegian Star in order to characterize the performance of the Scanship wastewater treatment system. This system is one of several that received certification for continuous discharge in Alaska by the U.S. Coast Guard in 2003. The three Norwegian Cruise Line's vessels that cruised Alaska in 2003 (Norwegian Sun, Norwegian Wind, and Norwegian Sky) were equipped with this wastewater treatment system, and sampling data for these ships show that they have equivalent treatment performance. Only the Norwegian Sun returned to Alaska for the 2004 cruise season, but she was joined by the Norwegian Star and the Norwegian Spirit, which installed Scanship wastewater treatment systems in the weeks prior to entering Alaska waters. Note that the Scanship system installed on the Norwegian Star is larger than that installed on the Norwegian Sun (to account for a greater number of passengers and additional crew). In addition, the Norwegian Star is equipped with a wastewater treatment sludge dewatering/drying system to allow for on-board incineration of sludge. EPA based the decision to sample the Star on sampling logistics (i.e., the ship that is most easily accessible, is available at a convenient time, etc.) and to evaluate the sludge handling system. EPA will sample the Star to collect information regarding the system design and day-to-day operation and maintenance, and will focus sampling not only on the treated effluent, but also include samples of the influent to wastewater treatment, effluent from individual treatment units, and treatment residues.

2.0 SHIP OVERVIEW

The Norwegian Star is a 91,000 gross ton cruise vessel, capable of carrying 2,240 passengers (double occupancy) and 1,100 crew. The Star's maximum cruising speed is 25 knots. The vessel has a length of 965 feet, a breadth of 105 feet, and was built with 15 decks to accommodate the passengers and crew. The Star provides 10 restaurants, 13 bars and lounges, and numerous other public areas (pools/whirlpools, casino, gift shops) for passenger entertainment. Other amenities include a photo lab for developing pictures, a spa, a gymnasium, and a beauty salon.

The remainder of Section 2 is a discussion of the Star's wastewater sources, collection, holding, and transfer system, and the wastewater treatment system. Note that certain information has been removed from this section to protect material for which a claim of confidential business information (CBI) has been made. The confidential version of this report can be found in the confidential portion of the Cruise Ship Rulemaking Record.

2.1 Graywater and Blackwater Generation

2.1.1 Graywater and Blackwater Sources

Section 2.1.1 has been redacted to prevent disclosure of material for which a claim of CBI has been made.

2.1.2 Graywater and Blackwater Collection, Holding, and Transfer System

The ship's collection, holding, and transfer system (CHT) collects and transfers graywater and sewage generated onboard to the ship's Scanship treatment system or to overboard discharge. For the purpose of this report, graywater refers to non-sewage wastewaters that are collected by the CHT system. The CHT system is composed of five subsystems, referred to by the ship's crew as the galley, food pulper, accommodations, laundry, and sewage systems. Additional information regarding the ship's CHT system has been redacted to prevent disclosure of material for which a claim of CBI has been made. Potable water is used as source water for all ship operations that generate graywater and sewage (e.g., laundry, galley, food pulper, sinks, showers, and toilets). Potable water is produced onboard and seldom bunkered while in port.

2.2 Graywater and Blackwater Treatment System

The Star is outfitted with a Scanship treatment system, an advanced wastewater treatment system that uses aerobic biological oxidation followed by dissolved air flotation and ultraviolet (UV) disinfection. Figure 2-1 is a simplified diagram of the Scanship treatment system. (Figure 2-1 has been modified to prevent disclosure of material for which a claim of CBI has been made.)

Wastewater from the galley, accommodations, laundry, and sewage CHT subsystems combine in one graywater and sewage holding tank. (Note that food pulper wastewater is not routed to the graywater and sewage holding tank, but instead is discharged without treatment outside 12 nm from shore.) The combined wastewater is then pumped through two coarse drum filters operated in parallel (mesh size 0.5mm) and then through two aerated bioreactors operated in series. Each bioreactor contains free floating plastic beads to support biological growth. Operators add a defoaming agent to the bioreactors. Following aeration and biodegradation in the bioreactors, the wastewater is pumped to two dissolved air flotation (DAF) units operated in parallel to separate solids. Anionic polymer and flocculant (polyaluminum chloride) are added to the wastewater to aid the flotation process.

From the DAF units, the wastewater is pumped to two polishing screen filters operated in parallel (mesh size 0.03 mm). In the final stage of treatment, the wastewater undergoes UV disinfection in three parallel UV units for destruction of bacteria and viruses. The UV units are cleaned approximately every three weeks using Metalbrite solutions containing 80% water and 20% phosphoric acid. The Metalbrite solution is reused until spent.

According to the ship's crew, the Scanship treatment system can treat 1,400 m^3 (370,000 gallons) per day of wastewater generated onboard. This is well in excess of its typical daily load, approximately 840 m^3 (222,000 gallons), as determined based on measured flows collected during this sampling episode.

The Scanship treatment system operates continuously, regardless of the ship's location (e.g., in port, at sea within Alaska waters, at sea outside Alaska waters). The vessel typically continuously discharges treated wastewater from this system overboard. Where overboard discharge is prohibited, such as in Glacier National Park, treated wastewater is diverted to storage in double-bottom holding tanks and held for eventual discharge overboard outside 12 nautical miles (nm). Treated wastewater storage capacity totals 1,437 m^2.

Treated wastewater is recycled back to the treatment system when effluent TSS concentrations exceed 27 mg/L (determined based on a correlation to measured effluent turbidity) to ensure that inadequately treated wastewater is not discharged.

The Scanship treatment system generates two types of residual waste: coarse drum filter solids and DAF solids (excess biomass from the bioreactors). These residuals are routed to the solids holding tank. Figure 2-2 is a diagram of the Star treatment residual handling system. (Figure 2-2 has been redacted to prevent disclosure of material for which a claim of CBI has been made.) The maximum wet solids generation rate is 25 m^3 per day. The combined residuals are dewatered using a centrifuge followed by a press to increase the solids content to over 20%. The dewatered solids are dried further in a dryer to over 60% dryness and then incinerated onboard. Incinerator ash is disposed of on shore as a non-hazardous waste. Wastewater generated from solids dewatering is returned to the graywater and sewage holding tank at the start of the Scanship treatment system.

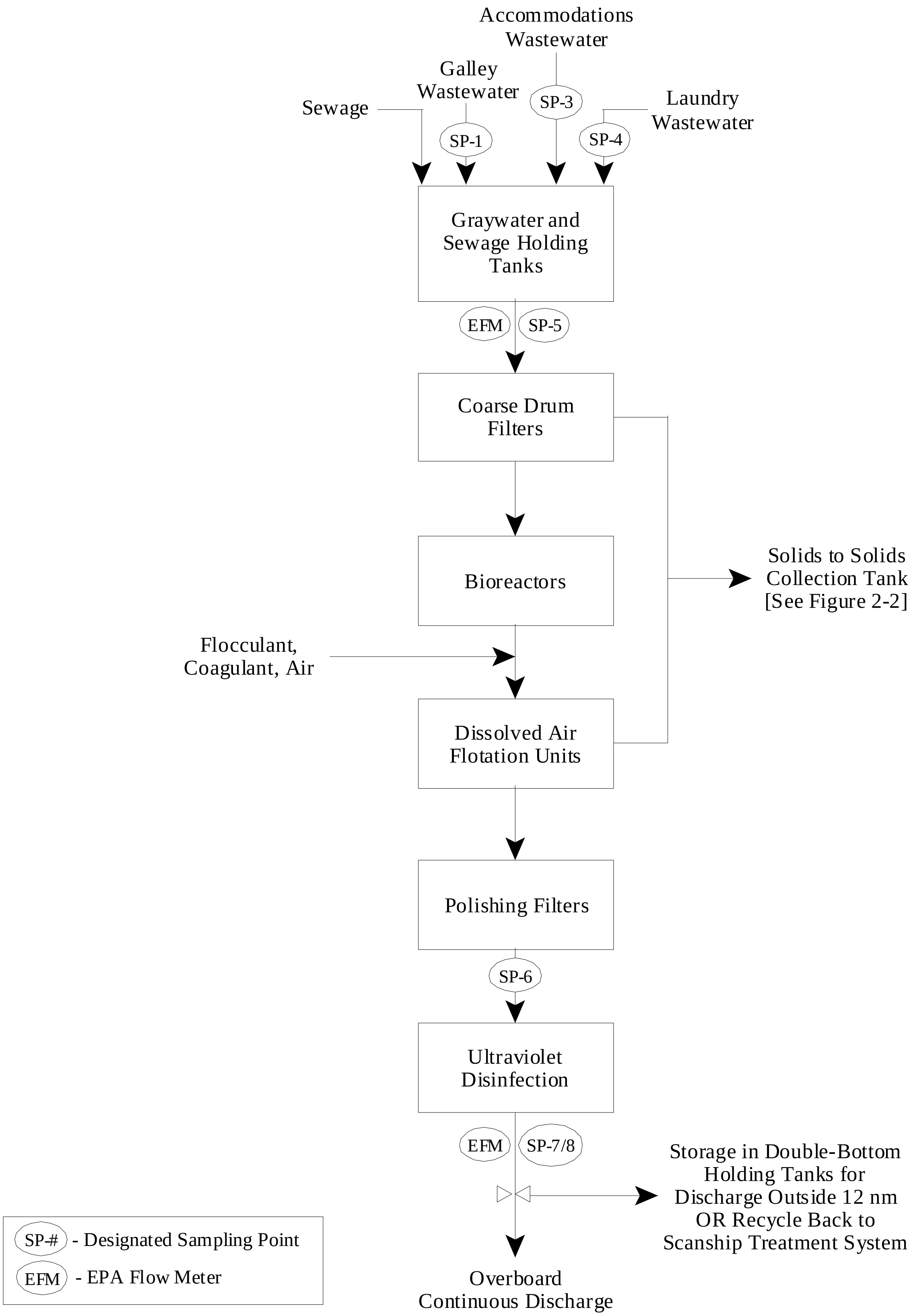

Figure 2-1. Blackwater/Graywater Treatment System - Norwegian Star

Figure 2-2 has been redacted to prevent disclosure of material for which a claim of confidential business information has been made.

Figure 2-2. Blackwater/Graywater Treatment Sludge Handling - Norwegian Star

3.0 SAMPLING APPROACH

This section contains detailed information regarding specific sampling points and locations, sampling methodologies, analytes, sampling frequency and duration, schedule, and logistics for sampling on board the Norwegian Star.

3.1 Sampling Point Selection

Table 3-1 lists the proposed sampling points, the number of samples to be collected, and the parameters for analysis for this sampling episode. Table 3-2 lists the sample type, sample container, sample volume, and on-board preservation for each parameter or parameter group which may be analyzed. Table 3-3 presents the sampling locations, flow measurement techniques, and the sample collection type (grab or composite).

Figures 2-1 and 2-2 show the sampling point (SP) locations for the Star blackwater/graywater treatment and treatment sludge handing systems. A brief description of what each sampling point will characterize is presented below:

- SP-1 Galley wastewater characterization;
- SP-2 Food pulper wastewater characterization;
- SP-3 Accommodations wastewater characterization;
- SP-4 Laundry wastewater characterization;
- SP-5 Influent to wastewater treatment system;
- SP-6 Influent to UV disinfection;
- SP-7 Effluent from wastewater treatment system;
- SP-8 Effluent from wastewater treatment system duplicate;
- SP-9 Dried wastewater treatment sludge;
- SP-10 Incinerator ash;
- SP-11 Source water;
- SP-12 Trip blank; and
- SP-13 Equipment blank.

3.2 Analyte Selection

Analytes included in the sampling program for the Star include those in the classes of pollutants listed below.

- Fecal coliforms;
- Escherichia coli (E. coli);
- Enterococci;
- Biochemical oxygen demand, 5-day (BOD_5);
- Chemical oxygen demand (COD);
- Total organic carbon (TOC);
- Total suspended solids (TSS);
- Settleable solids (SS);
- Total dissolved solids (TDS);
- Total Kjeldahl nitrogen (TKN);
- Ammonia as nitrogen;
- Nitrate/nitrite as nitrogen;
- Total phosphorus;
- Sulfate;
- Chloride;
- Alkalinity;
- Hexane extractable material (HEM);
- Silica-Gel Treated Hexane Extractable Material (SGT-HEM);
- Volatile organics;
- Semivolatile organics;
- Metals (total and dissolved);
- Hardness (calculated from metals data);
- Cyanide (total and available);
- Organo-phosphorous pesticides;
- Organo-halide pesticides;
- Chlorinated biphenyls congeners (PCBs); and
- Dioxins and furans.

Table 3-4 lists analyte and pollutant parameters along with their analytical method numbers and laboratory measurement techniques. Not all analytes and pollutant parameters will be analyzed at all sampling points. Appendix A of this document lists the individual parameters included in each analytical method. In addition to these analytes, the sampling crew will conduct field measurements at all sampling points, as identified in Table 3-5.

Certain conventional and non-conventional pollutants (Group I and Group II) will be collected in the same sample bottle at some sampling points. "Group I" parameters include TDS, TSS, chloride, sulfate, and alkalinity. "Group II" parameters include TOC, COD, ammonia as nitrogen, nitrate/nitrite as nitrogen, TKN, and total phosphorus. HEM and SGT-HEM will also be collected in the same sample bottle at each sampling point. All other parameters will be collected in individual bottles.

Due to the very short sample holding times for microbiologicals (fecal coliforms, E. coli, and enterococci - 6 hours), BOD_5 (48 hours), and SS (48 hours), an on-board laboratory will be used for analysis of these samples where necessary.

3.3 Sample Collection

Much of the information about the collection of samples for this sampling program is summarized in a series of tables as follows:

- Table 3-1, summarizes the sampling points and analytes to be studied;
- Table 3-2, summarizes the parameters, bottle types, sample volume, and preservation requirements; and
- Table 3-3, sampling locations, flow measurement techniques, and the sample collection type

To characterize the wastestreams on board the Star, the samplers will employ varying methods of sample collection depending on the sampling point, pollutant parameters, and the nature of the sample flow and composition at each sampling point. The following subsections provides a detailed description of the sample collection techniques.

Samplers will work in teams of two to ensure that proper sampling techniques are followed and adequate notes are taken at each sampling location. Samplers will wear disposable gloves, tyvek suit, and safety eyewear, and will observe precautions while collecting samples, remaining aware of the potential biohazards present.

Sample containers and bottles will be purchased pre-cleaned and certified and will not require rinsing with sample. Samplers will take care not to touch the insides of bottles or lids/caps during sampling. All samples collected during the sampling episode will be cooled immediately in an ice-water bath to 4°C and then placed into coolers containing bagged ice (or chemical ice) to maintain a sample temperature of 4°C throughout sample storage, shipment (or transfer for on-board analysis), and receipt at the analytical laboratories.

3.3.1 Flow Measurement Approach

Flow measurement data will be collected to support both the treatment system/ final effluent discharge and the graywater characterization sampling efforts. The availability of existing equipment on board the Star, accessibility of piping and tankage, and the capability of removing liquids from transfer lines will determine how flows are measured. Preferred flow measurement techniques, based on the ship visit to the Star are listed in Table 3-3, along with contingencies for obtaining flow data.

For those sampling points with existing flow totalizers, flow data will be recorded on the data sheet provided in Figure 3-1 at a minimum frequency of every six hours. If totalizer data is not available, then a series of instantaneous flow rates will be measured and recorded using an ultrasonic flow meter installed by the samplers. The flow measurements will provide the amount of wastewater processed in periods corresponding to analytical data collected. In the event that neither flow totalizer data nor reliable flow measurement can be made for a specific sampling point, flow rates will be estimated using tank level indicator readings or pump capacities and operating times.

Flow-weighted composite samples will be collected from the galley graywater (SP-1), accommodations graywater (SP-3), laundry graywater (SP-4), treatment system influent (SP-5), and treatment system effluent (SP-7/SP-8) using an automatic sampling machine. The flow meter will signal the automatic sampling machine to collect a sample each time a fixed quantity of wastewater has passed through the wastewater piping.

3.3.2 Graywater Characterization Samples

Graywater characterization samples that will be collected include galley (SP-1), food pulper (SP-2), accommodations (SP-3), and laundry (SP-4). Note that graywater characterization samples will be collected for up to five 24-hour periods. One exception is samples of food pulper wastewater, which will be collected during only one day. None of these sampling points have existing flow meters. The number of sampling days for graywater samples (other than food pulper wastewater) will depend on the ability of the advance sampling set-up team to have all sampling points operational by Day 1, and the capability of the sampling team to manage the collection, maintenance, and shipping of the large number of samples.

In general, graywater samples are analyzed for all pollutant parameters. Exceptions include pesticides, which are analyzed for in only galley wastewater samples to characterize possible pesticide sources in food preparation and pest management, and dioxins and furans, which are analyzed for in only laundry wastewater samples to characterize possible generation of dioxins and furans by bleaching operations. PCBs will not be analyzed in any graywater samples.

In the case of SP-1, SP-3, and SP-4, sampling crew will install strap-on flow meter on the outlet pipes from the galley, accommodations, and laundry wastewater holding tanks, respectively, as described in Table 3-3. The flow meters will signal the automatic sampling machines to collect samples each time fixed quantities of wastewater have passed through tank discharge piping.

At SP-2, food pulper wastewater is collected in the holding tank and pumped every few days for overboard discharge outside 12 nm. Therefore, at this sampling point, the sampling crew will prepare a manual composite sample and up to four grab samples collected during the food pulper wastewater discharge period. In this way the food pulper wastewater samples will be collected to represent the actual material that is being discharged.

During each 24-hour sampling period (or discharge period in the case of food pulper wastewater), a composite sample of up to 20-liters will be collected in 10-L glass composite sample containers from sampling points SP-1 through SP-4 to provide the required sample volume listed in Table 3-2, plus additional volume for laboratory quality control (see Section 3.4.6) and sample spillage. Composite sample containers will be maintained on ice throughout the 24-hours collection period. At the conclusion of each 24-hour sampling period, sample fractions will be poured from the composite sample containers into individual sample bottles using the procedure described in Section 5.1. Bottles will normally be filled to the shoulder of the bottle, leaving a small space for expansion and mixing. Filtering of samples for analysis of dissolved metals will be performed immediately upon receipt at the sample staging area.

Up to four grab samples for HEM/SGT-HEM, VOCs, total and available cyanide, and microbiologicals will be collected at each sampling point during each 24-hour sampling period. An equal number of graywater grab samples will be collected during peak and off-peak generation periods, with sample times determined based on an analysis of collected flow data. Each grab sample for microbiologicals will be analyzed separately at the on-board analytical laboratory. The HEM/SGT-HEM and total and available cyanide samples will be composited on board for a single analysis per sampling point per day, while VOC grab fractions will be composited at the laboratory for one analysis per sampling point per day.

Grab samples will be collected directly into sample fraction bottles when possible. When not possible (e.g., the pump cycle on a graywater collection tank is too quick to allow for collection of all grab samples), VOC samples will be collected into a specially-cleaned 1-L widemouth jar; the 40-ml VOC vials will be subsequently filled with sample from the widemouth jar. All VOC vials will be filled leaving a convex meniscus at the top of the bottle, with no air bubbles present; when the VOC lid is screwed on a small volume of water will be displaced and no air should be present in the bottle. All VOC vials will be pre-preserved with two drops of HCl per vial for biological activity. If field measurements (see Section 3.6) indicate free chlorine is present in the graywater samples at concentrations greater than 0.03

mg/L, then 7 drops (3 granules solid form) of sodium thiosulfate will be added to the sample vials prior to sample collection.

Graywater generation information will be recorded on the graywater generation data sheet provided in Figure 3-2. Information regarding the generation and disposition of waste streams from the photo labs, print shop, dry cleaning, chemical storage, and medical areas will be recorded on the data sheet provided in Figure 3-3. In addition, information regarding the use of pesticides, fungicides, and rodenticides and their potential to enter graywater and blackwater systems will be recorded on the data sheet provided in Figure 3-4. Finally, information regarding the graywater collection, holding, and transfer system will be recorded on the data sheet provided in Figure 3-5.

3.3.3 Graywater and Blackwater Treatment and Final Effluent Samples

Influent to wastewater treatment (SP-5), influent to UV (SP-6), and effluent from wastewater treatment (SP-7/SP-8) samples will be collected from the wastewater treatment system on board the Star. Wastewater treatment influent samples will be analyzed for all pollutant groups except dioxins and furans. Samples collected at the influent to the UV will be analyzed only for microbiologicals. Wastewater treatment effluent samples will be analyzed for all pollutants except pesticides, dioxins and furans, and PCBs.

Sampling crew will install strap-on flow meters at SP-5 and SP-7/SP-8 to signal automatic sampling machines to collect samples each time fixed quantities of wastewater have passed through sampling point piping. As another alternative, the crew may use the I/O on the existing flow meter at SP-7/SP-8 to signal the automatic sampling machine at this sampling point. Sampling point SP-8 does not require flow measurement since the four microbiological samples collected at this sampling point per 24-hour sampling period are grab samples.

During each 24-hour sampling period, a composite sample and up to four grab samples will be collected at each of the SP-5 and SP-7/SP-8 sampling points using the same procedure as described for graywater samples in Section 3.3.2.

Information regarding the design, operation, and maintenance of the wastewater treatment units will be recorded on the data sheet provided in Figure 3-6. In addition, information regarding the blackwater collection, holding, and transfer system will be recorded on the data sheet provided in Figure 3-5.

3.3.4 Treatment Residue Samples

Samples of the dried wastewater treatment sludge (SP-9) and incinerator ash (SP-10) will be collected as one time grab samples during the sampling episode. Treatment residue samples will be collected to represent the actual material that is being either incinerated or removed from the vessel. Specifically, dried wastewater treatment sludge will be collected from the sludge conveyor feed system to the on-board incinerator. Incinerator ash samples will be collected from the incinerator ash storage hopper. Dried wastewater treatment sludge samples will be analyzed for volatile organics, semivolatile organics, total metals, cyanide, Group I, and Group II. Ash samples will be analyzed for semivolatile organics, total metals, and dioxins and furans only.

3.3.5 Source Water Sample

A source water grab sample will be collected from the ship's potable water system (SP-11) to determine if any of the targeted pollutants are present as background contamination. The source water sample will be analyzed for all of the target parameters, except for HEM/SGT-HEM, pesticides, dioxins and furans, and PCBs.

Information regarding the potable water source and treatment will be recorded on the data sheet provided in Figure 3-7.

3.3.6 Quality Assessment Samples

Duplicate samples are collected as part of the quality assurance program for this sampling episode. Duplicate samples are collected as separate aliquots in the field. One field duplicate per every 10 samples will be collected from sampling point SP-8 and analyzed for all pollutant parameters with the exception of HEM/SGT HEM, pesticides, dioxins and furans, and PCBs. Microbiological duplicate samples will also be collected from SP-8, but at a lesser frequency of one duplicate per 20 samples. (Duplicate samples for dioxins and furans and pesticides were collected on board another cruise vessel to satisfy program QC requirements.) Results of the duplicate analyses will be used to evaluate precision, including variability in sample collection, handling, preparation, and analysis.

One trip blank (SP-12) will be collected and analyzed for volatile organics. The sample will consist of high-performance liquid chromatography (HPLC) water poured into sampling bottles prior to the sampling episode, and shipped to the sampling location. The trip blank will be shipped back (unopened) to the laboratory along with collected samples. This blank will be used to evaluate possible contamination during shipment and handling of samples.

An automatic sampler equipment blank (SP-13) will be collected and analyzed for semivolatile organics, total metals, and dissolved metals. The equipment blank will consist of HPLC water pumped through a sampler, tubing, and into a composite jar from which a fraction will be poured off. Equipment blanks are used to evaluate possible contamination caused by sampling equipment or by sampling equipment decontamination procedures.

As part of standard laboratory quality control (QC), matrix effects on analytical performance are assessed through the analysis of matrix spikes and laboratory duplicates. The matrix effects will be assessed on the effluent from the wastewater treatment system (SP-8) for all parameters except pesticides, dioxins and furans, PCBs, and certain classical wet chemistry parameters. (The matrix effects for pesticides were assessed on board another cruise vessel to satisfy program QC requirements. Matrix effects assessment QC samples are not required for isotope dilution procedures (i.e., dioxins and furans by Method 1613 and chlorinated biphenyls congeners by Method 1668) and are not applicable for certain classical wet chemistry parameters.) Matrix effects assessment analyses are conducted on 10 percent of the samples within a sampling event. Consequently, additional sample volume must be collected for these QC analyses. The sampling team will be responsible for collecting, labeling, and shipping the laboratory QC volumes. Laboratory QC volumes will be collected as part of the composite volume and poured into separate sample bottles at the same time as other sample aliquots are prepared.

Laboratory duplicates will be collected as QC samples specifically for microbiologicals and will be collected as a single sample that is split and analyzed as two separate samples. Laboratory duplicates will be collected at a frequency of one per 20 samples at SP-8. Several other microbiological QC procedures will be required prior to sampling, such as positive and negative controls, dilution water blanks, and media and sample bottle sterility checks. The procedures and frequencies for these analyses are outlined in the *Quality Assurance Project Plan for Rulemaking for Large Cruise Ships in Alaska Waters* (1).

3.4 <u>Preservation, Shipping, and Analysis</u>

All samples will be maintained on ice immediately upon collection. Chemical preservatives will be added on board according to method-specified protocols either upon sample collection (i.e., grab samples) or following preparation of sample fractions from the composite sample (see Section 5.1). Table 3-2 lists the analytical fraction type, sample container, sample volume, and preservation method for each type of analysis. Preservation may need to be repeated as chemical reactions progress in samples. The type and amount of preservation used will be recorded on sample preservation log sheets (Figure 3-8). The samples will be packed in ice chests with a sufficient quantity of wet ice to maintain a temperature of 4°C (+/- 2°C) until the Star arrives in port. Exceptions include metals samples which have no temperature requirements.

As the Star docks in Juneau or Ketchikan, Alaska, or possibly Victoria, BC, samples will be prepared for overnight shipment via Federal Express to the laboratories specified by EPA's Sample Control Center. (Exceptions include samples that will be shipped or offloaded directly to a contractor's Juneau analytical laboratory for analysis (e.g., BOD_5).) All samples being shipped via Federal Express will be packed in ice chests containing either chemical ice or double-bagged wet ice. All samples shipped via Skagway Air will be packed in ice chests containing chemical ice.

3.5 Field Measurements

Temperature, pH, salinity, conductivity, turbidity, sulfide, and free and total chlorine will be measured and recorded by the sampling crew at each sampling point when each grab sample is collected. A 1-liter glass jar will be filled during collection of each grab sample set for field measurements. Temperature and pH will be measured immediately after the collection of the field measurement aliquot; the other field measurements will be conducted shortly thereafter, either in the field or in the sample staging area. Samplers will follow applicable test kit calibration procedures specified by the manufacturer. Table 3-5 summarizes the field measurements, how they are to be taken, and the measurement frequency. Test meters instructions and calibration requirements for conductivity, salinity, sulfide, and free and total chlorine field measurements can be found in Appendix B.

Field sampling log sheets (Figure 3-9) will be completed at each sampling point for each 24-hour sampling period. This sheet will record the sampling methodology, names of the samplers, sample collection times, field measurements, and any notes and observations.

3.6 Sample Labeling

Each sample will be coded with a unique sample number and labeled at the time of collection. The self-adhesive label will be completed in indelible ink and will contain the following information:

- Sample number;
- Sampling episode number;
- Sampling point description;
- Sampling point and day;
- Analysis to be performed;
- Sample bottle type;
- Date of sample collection; and
- Preservation used.

Once applied to the sample container, labels will be covered with clear tape to prevent tampering, abrasion, smearing, or loss during transit.

3.7 Chain-of-Custody Record

To maintain a record of sample collection, shipment, and receipt by the laboratory, a Traffic Report will be filled out for each sample fraction at each sampling location. These forms will be completed and used to document sample custody transfer from the field to the laboratory, regardless of whether the analyses are completed on board or shipped to a designated laboratory. At the time of sample shipment, a copy of the traffic report will be sent to Sample Control Center, another copy will be kept by sampling personnel, and the remainder of the copies will be transmitted with the samples to the analytical laboratories. Figure 3-10 includes an example Traffic Report. When the samples are received by the designated analytical laboratory, a copy of the traffic report will be sent to Sample Control Center to acknowledge receipt and the condition of the samples.

3.8 Quality Assurance/Quality Control

Quality assurance/quality control (QA/QC) procedures applicable to the Star sampling episode are outlined in the *Quality Assurance Project Plan for Rulemaking Support for Large Cruise Ships in Alaska Waters* (1). The QA/QC program for sample collection on board large cruise vessels will include the following:

- Documentation of sample custody using Traffic Reports;
- Collection of field duplicate samples;
- Collection of trip blank(s) for VOC analyses;
- Collection of equipment blank(s) for semivolatile organics and total and dissolved metals analyses;
- Collection of laboratory duplicate samples for microbiologicals; and

- Analysis of positive and negative controls, dilution water blanks, and sample bottle and media sterility checks for microbiologicals prior to use in sampling.

3.9 <u>Sample Splitting</u>

The Star has the option to collect duplicate samples (split samples) at each of the sampling points. If this option is exercised, the owner of the Star or their representative will supply all of the personnel, equipment, glassware, and reagents required to collect the split samples and to coordinate the analysis of samples. Norwegian Cruise Line representatives have not indicated a desire to collect split samples.

Table 3-1

Samples for Collection On Board Norwegian Star

Sampling Point Number	Sampling Point Name	Micros	Vol	Semivol	Total Metals	Dissolved Metals (a)	Cyanide (b)	HEM/ SGT-HEM	BOD	Solids	Group I	Group II	Pest (c)	D/F	PCB
SP-1	Galley Wastewater Characterization	10 (d)	5	5	5	5	5	5	5	5	5	5	1		
SP-2	Food Pulper Wastewater Characterization	2 (e)	1	1	1	1	1	1	1	1	1	1			
SP-3	Accommodations Wastewater Characterization	10 (d)	5	5	5	5	5	5	5	5	5	5			
SP-4	Laundry Wastewater Characterization	10 (d)	5	5	5	5	5	5	5	5	5	5		1	
SP-5	Influent to Wastewater Treatment System	15 (f)	5	5	5	5	5	5	5	5	5	5	1		1
SP-6	Influent to UV Disinfection	15 (f)													
SP-7	Effluent from Wastewater Treatment System	15 (f)	5	5	5	5	5	5	5	5	5	5			
SP-8	Effluent from Wastewater Treatment System (Field Duplicate)	4+4QC (g)	3+6QC	3+6QC	3+6QC	3+6QC	3+6QC	6QC	3	3	3+6QC	3+6QC			
SP-9	Dried Wastewater Treatment Sludge		1	1	1		1				1	1			
SP-10	Incinerator Ash			1	1									1	
SP-11	Source Water	1	1	1	1	1	1		1	1	1	1			
SP-12	Trip Blank		1												
SP-13	Equipment Blank			1	1	1									
Total Number of Samples (Excluding QC)		**82**	**32**	**33**	**33**	**31**	**31**	**26**	**30**	**30**	**31**	**31**	**2**	**2**	**1**

(a) Dissolved metals samples will be analyzed for filterable waste streams only.
(b) Cyanide includes both total and available cyanide.
(c) Pesticides includes both organo-phosphorous and organo-halide pesticides.
(d) Two grab samples per day for five days.
(e) Up to two grab samples for one discharge period.
(f) Three grab samples per day for five days.
(g) Includes field duplicates for 5 percent of samples and laboratory duplicates for 5 percent of samples.

Table 3-1 (Continued)

Micros - Fecal coliforms, E. coli, and enterococci.
Vol - Volatile organics.
Semivol - Semivolatile organics.
HEM/SGT-HEM - Hexane extractable material and silica gel treated hexane extractable material.
BOD - Biochemical oxygen demand.
Solids - Settleable solids.
Group I - Total suspended solids (TSS), total dissolved solids (TDS), sulfate, chloride, and alkalinity.
Group II - Total organic carbon (TOC), chemical oxygen demand (COD), ammonia as nitrogen, nitrate/nitrite as nitrogen, total Kjeldahl nitrogen (TKN), and total phosphorus.
QC - With the exception of microbiologicals, QC samples include sample volume for both a matrix spike and a matrix spike duplicate (i.e., two samples). For microbiologicals, QC samples refer to confirmation analyses performed on 10% of the samples
Pest-Organo-phosphorus and organo-halide pesticides
D/F-Dioxins and Furans
PCB-Chlorinated Biphenyls Congeners

Table 3-2

Summary of Sample Container and Preservation Requirements

Parameter	Sample Container	On-Board Preservation (d)
Fecal Coliforms	120 ml sterile bottle (c)	100 mg/L $Na_2S_2O_3$, 4°C
E. coli	120 ml sterile bottle (c)	100 mg/L $Na_2S_2O_3$, 4°C
Enterococci	120 ml sterile bottle (c)	100 mg/L $Na_2S_2O_3$, 4°C
Volatile Organics	Two 40-mL glass vials (c)	3 granules (10 mg) or 7 drops $Na_2S_2O_3$ per vial, 2 drops HCl per vial, 4°C
Semivolatile Organics	Two 1-L amber glass bottles	80 mg/L (8 mL/L) $Na_2S_2O_3$, 4°C
Total Metals	1-L plastic bottle	None required
Dissolved Metals	1-L plastic bottle	0.45 um filtration
HEM/SGT-HEM	1-L wide mouth glass jar (c)	HCl or H_2SO_4 to pH <2, 4°C
Cyanide, Total	500-mL plastic bottle	Ascorbic acid (0.6 g/L) to remove Cl_2, NaOH to pH >12, 4°C. If sulfide is present, add appropriate amount of lead carbonate to precipitate sulfide (e.g., 44mg/500mL for sulfide concentration of 1 mg/L), followed by 0.45 um filtration and raising pH.
Cyanide, Available	500-mL amber glass bottle	Ascorbic acid (0.6 g/L) to remove Cl_2, NaOH to pH >12, 4°C. If sulfide is present, add appropriate amount of lead carbonate to precipitate sulfide (e.g., 44mg/500mL for sulfide concentration of 1 mg/L), followed by 0.45 um filtration and raising pH.
Biochemical Oxygen Demand (5-day)	1-L plastic bottle	4°C
Settleable Solids	1-L plastic bottle	4°C
Group I (a)	1-L plastic bottle	4°C
Group II (b)	1-L and 500 mL glass bottles	H_2SO_4 to pH <2, 4°C
Dioxins and Furans	Two 1-L amber glass bottles	If pH>9, H_2SO_4 to pH 7-9 80 mg/L (8 mL/L) $Na_2S_2O_3$, 4ºC
Organo-Phosphorus Pesticides	Two 1-L amber glass bottles	NaOH or H_2SO_4 to pH 5-9 80 mg/L (8 mL/L) $Na_2S_2O_3$, 4ºC
Organo-Halide Pesticides	Two 1-L amber glass bottles	NaOH or H_2SO_4 to pH 5-9 80 mg/L (8 mL/L) $Na_2S_2O_3$, 4ºC
Chlorinated Biphenyls Congeners	Two 1-L amber glass bottles	H_2SO_4 to pH 2-3 80 mg/L (8 mL/L) $Na_2S_2O_3$, 4ºC

(a) Group I includes total dissolved solids (TDS), total suspended solids (TSS), sulfate, chloride, and alkalinity.
(b) Group II includes total organic carbon (TOC), chemical oxygen demand (COD), ammonia as nitrogen, nitrate/nitrite as nitrogen, total Kjeldahl nitrogen (TKN), and total phosphorus.
(c) Grab samples for microbiologicals, volatile organics, HEM/SGT-HEM analysis will be collected separately for each composite aliquot.
(d) Addition of sodium thiosulfate and ascorbic acid is required only if residual chlorine is present in the sample at a concentration greater than 0.03 mg/L.

Table 3-3

Summary of Sampling Locations, Flow Measurement Techniques, and Sample Collection Types Norwegian Star

Sampling Point Number	Sampling Point Description	Sampling Location	Flow Measurement Technique	Sample Collection Type
SP-1	Galley Wastewater Characterization	Discharge pipe from galley wastewater holding tank (15Paft). (This is the same sampling location as SP-2.)	Install strap-on flow meter on discharge pipe from the galley wastewater holding tank. Alternative is to use holding tank level data collected by the ship. Please provide instantaneous tank level data recorded in the ship's control system for a typical multi-day cruise.	Install "T" sample tap at pressure gauge on discharge pipe from galley/food pulper wastewater holding tank. Composite samples collected from one side of the sample tap, and grab samples collected from the other side of the sample tap.
SP-2	Food Pulper Wastewater Characterization	Discharge pipe from food pulper wastewater holding tank (15Pfwd). (This is the same sampling location as SP-1.)	None required. Food pulper wastewater holding tank is pumped every few days to discharge the wastewater outside 12 nm. Will request 15Pfwd tank level prior to commencing overboard discharge. Will request typical food pulper wastewater generation rates and duration during sampling episode.	Install "T" sample tap at pressure gauge on discharge pipe from galley/food pulper wastewater holding tank. Composite grab samples from one side of the "T" sample tap for manual compositing during overboard discharge period.
SP-3	Accommodations Wastewater Characterization	Accommodations wastewater collection tank discharge pumps.	Install strap-on flow meter on outlet pipe from collection tank. Alternative is to use collection tank level data collected by the ship. Please provide instantaneous tank level data recorded in the ship's control system for a typical multi-day cruise.	Need to install "T" sample tap (if only one pump used) or "H" sample tap (if both pumps used). Composite samples collected from one side of the sample tap, and grab samples collected from the other side of the sample tap.
SP-4	Laundry Wastewater Characterization	Laundry wastewater holding tank discharge pumps.	Need to identify flow meter location; did not observe during 5/18/04 ship visit because deck plating could not be removed. Sampling crew to install strap-on flow meter. Alternative is to use holding tank level data collected by the ship. Please provide instantaneous tank level data recorded in the ship's control system for a typical multi-day cruise.	Need to install "T" sample tap (if only one pump used) or "H" sample tap (if both pumps used). Composite samples collected from one side of the sample tap, and grab samples collected from the other side of the sample tap.

Table 3-3 (Continued)

Sampling Point Number	Sampling Point Description	Sampling Location	Flow Measurement Technique	Sample Collection Type
SP-5	Influent to Wastewater Treatment System	Inlet pipe to drum filters.	Install strap-on flow meter at the influent to wastewater treatment. Alternative is to use the existing Siemens I/O to communicate with automatic sampling machine provided by sampling crew. If data from Scanship control system can be downloaded to disk, please provide Scanship system data (pump operation, instantaneous tank levels, etc.) collected for a typical multi-day cruise.	Need to install "T" sample tap on inlet pipe to drum filters. See existing pH probe port. Composite samples collected from one side of the sample tap, and grab samples collected from the other side of the sample tap.
SP-6	Influent to UV Disinfection	Inlet pipe to UV disinfection.	None required. If data from Scanship control system can be downloaded to disk, please provide Scanship system data (pump operation, instantaneous tank levels, etc.) collected for a typical multi-day cruise.	Use existing sampling port from pumps at inlet pipe to UV disinfection for grab samples for microbiologicals analysis only. Sampling port is located on the pumps prior to UV disinfection.
SP-7/SP-8	Effluent from Wastewater Treatment System and Duplicate	New effluent line to overboard discharge port. Will be installed after 5/18/04 ship visit and prior to cruising in Alaska.	Sampling crew to install a strap-on flow meter on new effluent line. If data from Scanship control system can be downloaded to disk, please provide Scanship system data (pump operation, instantaneous tank levels, etc.) collected for a typical multi-day cruise.	Need to install "T" sample tap on new effluent line to discharge port. Composite samples collected from one side of the sample tap, and grab samples collected from the other side of the sample tap.
SP-9	Dried Wastewater Treatment Sludge	Access hatch on conveyor that transfers dried wastewater treatment sludge from the sludge hopper to the incinerator.	Not applicable. Will request typical dried wastewater treatment sludge generation rates during sampling episode.	Use existing access hatch; no modifications needed. Collect single grab sample. (Conveyor needs to be turned off with either lock out or local operator control for sampling safety.)
SP-10	Incinerator Ash	Incinerator ash collection bag.	Not applicable. Will request typical incinerator ash generation rates during sampling episode.	Manual grab sample from incinerator ash collection bag.
SP-11	Source Water	Ship's potable water system following any chlorination, end of distribution.	None required. Will request information regarding water bunkering during sampling episode.	Single grab sample.
SP-12	Trip BlankSSsampling room.		Not applicable.	Single grab sample.

Table 3-3 (Continued)

Sampling Point Number	Sampling Point Description	Sampling Location	Flow Measurement Technique	Sample Collection Type
SP-13	Equipment Blank	Sampling tap and sampling equipment (i.e., automatic sampling machine).	Not applicable.	HPLC water pumped through representative sampling tap and sampling equipment. Single grab sample. Please provide an extra sample tap (“T” or “H”) for use in preparing the equipment blank.

Table 3-4

Standard Analytical Methods and Procedures for Samples Collected On Board the Star

Method No.	Title	Method Type
SM 9222D	Fecal Coliforms	Membrane filtration
SM 9223B	Escherichia Coli (E. coli)	Multiple tube/multiple well
ASTM D6503-99	Enterococci	Multiple tube/multiple well
EPA 160.2	Residue, Non-filterable (TSS)	Gravimetric
EPA 160.5	Settleable Matter (SS)	Volumetric
EPA 160.1	Total Dissolved Solids (TDS)	Gravimetric
SM 2320 B	Alkalinity	Titrimetric
EPA 375.1, 375.3, or 375.4	Sulfate	Colorimetric, Gravimetric, or Turbidimetric
EPA 325.2 or 325.3	Chloride	Colorimetric or Titrimetric
EPA 351.2, 351.3, or 351.4	Total Kjeldahl Nitrogen (TKN)	Colorimetric, Titrimetric, or Potentiometric
EPA 350.1, 350.2, or 350.3	Ammonia as Nitrogen	Colorimetric, Titrimetric, or Potentiometric
EPA 353.1, 353.2, or 353.3	Nitrate/Nitrite as Nitrogen	Colorimetric or Spectrophotometric
EPA 365.2 or 365.4	Total Phosphorus	Colorimetric
EPA 405.1	Biochemical Oxygen Demand (BOD_5)	Titrimetric
EPA 410.1, 410.2, 410.3, or 410.4	Chemical Oxygen Demand (COD)	Titrimetric or Colorimetric
EPA 415.1	Total Organic Carbon (TOC)	Combustion or Oxidation
EPA 335.2	Total Cyanide	Titrimetric or Spectrophotometric
EPA 1677	Available Cyanide	Flow Injection, Ligand Exchange, Amperometry
EPA 1664A	Hexane Extractable Material and Silica Gel Treated Hexane Extractable Material (HEM/SGT-HEM)	Gravimetric
EPA 200.7, 200.8, 200.9, and 245.7 (Mercury only)	Metals by Inductively Coupled Plasma Atomic Emission Spectrometry, Mass Spectrometry, and Atomic Absorption Spectroscopy	GFAA, ICP, ICP/MS and CVAA
SM 2340 B	Hardness by Calculation	Calculation from metals results
EPA 624	Volatile Organic Compounds by GC/MS	GC/MS
EPA 625	Semivolatile Organic Compounds by GC/MS	GC/MS
EPA 1613B	Dioxins and Furans by Isotope Dilution HRGC/MS	HRGC/MS
EPA 1657	Organo-Phosphorous Pesticides	GC-FPD
EPA 1656	Organo-Halide Pesticides	GC-HSD
EPA 1668A	Chlorinated Biphenyls Congeners by Isotope Dilution HRGC/MS	HRGC/MS

Table 3-5

Sampling Point Field Measurements

Field Measurements	Method	Frequency
Temperature	Thermometer	Each time grab samples (e.g., VOCs) are collected
Turbidity	Turbidity meter	Each time grab samples (e.g., VOCs) are collected
Salinity	Salinity meter	Each time grab samples (e.g., VOCs) are collected
Conductivity	Conductivity meter	Each time grab samples (e.g., VOCs) are collected
Sulfide	Colorimetric test kit	Each time grab samples (e.g., VOCs) are collected.
pH	Four color indicator strip	Each time grab samples (e.g., VOCs) are collected
Free and Total Chlorine	Colorimetric test kit	Each time grab samples (e.g., VOCs) are collected

Flow Meter Measurement Data Sheet

Vessel:			**Discharge:**		
Meter Information					
Meter Type:	Serial #:		Calibration:		
Install Location:			Date:	Time:	Gallons:
De-Install Information:			Date:	Time:	Gallons:

Day/ Date	**Time**	**Gallons**		**V_s**	**Alarms**	**Day/Date**	**Time**	**Gallons**		**V_s**	**Alarms**
		Totalizer	**Daily**					**Totalizer**	**Daily**		

Figure 3-1. Flow Meter Measurement Data Sheet

GRAYWATER GENERATION DATA SHEET

Vessel:
Date:
Recorded By:
Vessel Point(s) of Contact:

Number of Passengers and Number of Crew Actually on Board:

Unusual Maintenance or Operational Activities Described By Vessel Point(s) of Contact:

Number and Time of Meals Served by Day (include passengers and crew) :
Breakfast:
Lunch:
Dinner:
Other Meals:

Were Dishwashers Operated? (Circle one) Yes / No

If yes, what weight, number of pieces, or number of loads were washed?
What times were dishes washed by day?
Estimated volume of water per load:
Detergent name (obtain MSDS if available):

Was Laundry Washed? (Circle one) Yes / No

If yes, number of hours per day laundry was operated:
Weight, number of pieces, or number of loads washed per day:
What times were dishes washed by day?
Estimated volume of water per load:
Are there floor drains in the laundry? What and where do they drain?
Detergent and other chemicals names (obtain MSDS if available):

Other Sources (e.g., small pantries, steward stations, cleaning stations):
Times these sources are generated:
Estimated volume per source:

Figure 3-2. Graywater Generation Data Sheet

SPECIAL WASTES GENERATION AND DISPOSITION DATA SHEET

Vessel:
Date:
Recorded by:

Photo Lab(s) On Board: yes or no (circle one)
Print Shop(s) On Board: yes or no (circle one)
Dry Cleaning On Board: yes or no (circle one)
Chemical Storage Area On Board: yes or no (circle one)
Medical Infirmary On Board: yes or no (circle one)
Garbage Room On Board: yes or no (circle one)

For each of the above areas, describe the following:

Waste handling and disposition:

Any waste treatment (e.g., silver recovery in photo lab)? What is the disposition of treated waste and any residuals (e.g., silver recovery filter and filtrate)?

Inspect area for floor drains. Are drains blocked or open? Where do the floor drains lead? Describe any streams that enter the floor drains.

Inspect area for sinks. Is sink drain blocked or open? What is the disposition of sink water? What streams enter or potentially the sink (e.g., hand washing, rinse/clean equipment, prepare chemical solutions)?

Inspect area for chemical storage. Are chemicals stored over a sump or other secondary containment?

Figure 3-3. Special Wastes Generation and Disposition Data Sheet

PESTICIDE, FUNGICIDE, AND RODENTICIDE USE DATA SHEET

Vessel:
Date:
Recorded by:

Pesticides Used On board: yes or no (circle one)

Pesticide Name	Target Pest(s)	Amount Used/yr	MSDS Obtained (yes/no)

List Locations Where Pesticides are Normally Applied and Stored On Board and Dates Applied:

Potential to Enter Graywater/Blackwater Systems (e.g., application, spills, floor drains)?

Person(s) Responsible for Pesticide Application:

Fungicides Used On board: yes or no (circle one)

Fungicide Name	Target Fungi	Amount Used/yr	MSDS Obtained (yes/no)

List Locations Where Fungicides are Normally Applied and Stored On Board and Dates Applied:

Potential to Enter Graywater/Blackwater Systems (e.g., application, spills, floor drains)?

Person(s) Responsible for Fungicide Application:

Rodenticides Used On board: yes or no (circle one)

Rodenticide Name	Target Rodent	Amount Used/yr	MSDS Obtained (yes/no)

List Locations Where Rodenticides are Normally Applied and Stored On Board and Dates Applied:

Potential to Enter Graywater/Blackwater Systems (e.g., application, spills, floor drains)?

Person(s) Responsible for Rodenticide Application:

Figure 3-4. Pesticide, Fungicide, and Rodenticide Use Data Sheet

COLLECTION, HOLDING, AND TRANSFER (CHT) TANK DATA SHEET

Vessel:
Date:
Recorded by:

Tank Number or Identification:

Wastewater Source(s):

Tank Volume:________ m^3 or gallons

Does the Tank Have Vacuum: yes or no (circle one):

Vacuum: ____ mm Hg

Tank Material of Construction:

Is this a double bottom tank: yes or no (circle one)?

Normal Operating Volume: ______ m^3

Automated Tank Gauging and Discharge System: yes or no (circle one)

Discharge Type: batch or continuous (circle one)

Totalizer or Flow Meter on Discharge Line: yes or no (circle one)

Discharge Flow Rate: _____ m^3/min or m^3/day

Wastewater Destination After Leaving the Tank:

Approximate Diameter of Discharge Line: ______ inches

Screens or Filters Present on Either Influent or Discharge Lines (describe):

Chemical Additions to Tank:

Chemical Name	Purpose	Amount	MSDS (yes/no)
__________________	______________	_______ kg/day	____________
__________________	______________	_______ kg/day	_____________
__________________	______________	_______ kg/day	_____________

Is sludge removed from this tank (describe frequency, amount, destination)?:

Figure 3-5. Collection, Holding, and Transfer (CHT) Tank Data Sheet

WASTEWATER TREATMENT UNIT DATA SHEET

Vessel:
Date:
Recorded by:

Description of Treatment Unit:

Manufacturer:

Model:

Design Drawings Obtained: yes or no (circle one)

Design Capacity: _________ gpd or gpm (circle one)

Typical Operating Flow Rate: _________ gpd or gpm (circle one)

Operational period: _____ hours

Chemical Additions:

Chemical	Amount	Units	MSDS Obtained
_______________	___________	_______	___________
_______________	___________	_______	___________
_______________	___________	_______	___________

Electrical Requirements:

Volts: _____ Amps: ______ Horsepower: ________

Sludge Generation: yes or no (circle one)
If yes, describe frequency, amount, and destination:

Was maintenance performed on treatment unit: yes or no (circle one)
If maintenance was performed, estimate labor: ______ hours

List operating parameters recorded (e.g., flow, temperature, pressure, pH), typical values, and range for this unit. Record or obtain copy or printout of logs for the duration of the sampling episode.

Figure 3-6. Wastewater Treatment Unit Data Sheet

SOURCE WATER DATA SHEET

Vessel:
Date:
Recorded by:

Is Potable Water Generated On Board the Vessel: yes or no (circle one)

Describe the On-board Potable Water Treatment and Disinfection Method:

Port (City) Where Source Water is Obtained if Not Generated On board: _______________

Treatment Method for Source Water Obtained in Port:

Disinfection Method for Source Water Obtained in Port:

Fluoride Added to Water Obtained in Port: yes or no (circle one)

Additional Disinfection Performed On Water Obtained in Port: yes or no (circle one)

Describe Additional On-board Disinfection Method:

Description of Source Water Sample Collection Point On Board Cruse Ship:

Figure 3-7. Source Water Data Sheet

Sampling Episode ______

Preservation Chemicals - List Strength of Solution from Bottle

HCl ________________ Ascorbic Acid____________

H_2SO_4 ______________ NaOH ____________

$Na_2S_2O_3$ ____________ Lead Carbonate____________

Sample Number	Analysis	Date	Name	Chemical	Initial pH	Final pH	Number of Drops

Figure 3-8. Sample Preservation Log Sheet

Date: ___________

Sampling Episode: __________

Sampling Point: ___________

Sample Numbers: ______________________

Manual Composite ☐ Grab ☐

Automatic Composite ☐

Time of Compositing period, if applicable:

Start Time ________ ☐ AM ☐ PM

End Time _________ ☐ AM ☐ PM

Equipment Used: ____

Samplers' Names: ____

Aliquot	Time	Temp °C	Turbidity (NTU)	pH	Sulfide (mg/L)	Salinity (ppt)	Conductivity (µS/cm)	Free Chlorine (mg/L)	Total Chlorine (mg/L)
1									
2									
3									
4									
5									
6									
Composite									

Notes: (include observations of odor and color of each aliquot, take pictures if necessary)

Figure 3-9. Field Sampling Log Sheet

United States **Environmental Protection Agency** Washington, DC 20460	
EPA	
	EPISODE NO:
	RANGE OF SAMPLE NOS:

TRAFFIC REPORT USEPA ENGINEERING AND ANALYSIS DIVISION SAMPLE CONTROL CENTER	Return completed form to: P.O. BOX 1407 ALEXANDRIA, VA 22313 (703) 519-1140

INDUSTRIAL FIRM SAMPLED	SHIPPING & INFORMATION
NAME:	SHIP TO:
CITY:	ATTN:
STATE:	CARRIER:
INDUSTRIAL CATEGORY:	AIRBILL:
	DATE SHIPPED:
CONFIDENTIAL (Y/N):	SAMPLING OFFICE/SAMPLER:

SAMPLE POINT DESCRIPTION											SAMPLE ANALYSES						
SAMPLE NUMBER	SOURCE WATER (city, river, well)	IN LINE PROCESS	UNREATED EFFLUENT (raw wastewater)	TREATED EFFLUENT	OTHER (specify)	ADDITIONAL SAMPLE DESCRIPTION	PH LEVEL	PRESERVED (Y/N)	G=GRAB / C=COMPOSITE	SAMPLE COLLECTION TIME / DATE							

Comments:

EPA Form 7500-50 (Rev 6-94) Previous editions are obselete.

Page 1: Sample Contro Center Copy

Copy of Page 1: Sampler Copy

Page 2: Lab Copy

Copy of Page 2: Lab Copy for return to Sample Control Center

Figure 3-10. Example Traffic Report

4.0 SAMPLING ACTIVITIES

This section discusses the sampling team organization, ship visit preparation, and sampling activities.

4.1 Sampling Team Organization

The sampling crew will consist of Donald Anderson and Elvira Martinez from EPA, a crew chief (Jennifer Biancuzzo), eight crew members, and two laboratory anlytical contractors who will be responsible for all on-board laboratory analyses. The crew chief will be responsible for all sample collection, preservation, and shipping activities on board. After completion of the sampling episode, the analytical results from each laboratory will be collated. This information will be summarized and transmitted, along with a trip report, to EPA. After EPA review, the report will be forwarded to the cruise line for their review.

4.2 Pre-Visit Preparation

As a part of preparing the team for the sampling event on board the Star, the crew chief will distribute the Norwegian Star Sampling and Analysis Plan to each team member and make sure they are completely familiar with the sampling plan and the health and safety requirements specific to the Star found in Section 6.0. Cruise vessel personnel shall also be given copies of this sampling and analysis plan prior to the start of sampling.

The crew chief will coordinate the procurement and shipment of all necessary sampling and health and safety equipment.

Upon arrival on Sunday August 1, two members of the sampling crew will attend a health and safety briefing lead by the ship's Environmental Officer and begin to set up sampling equipment. On Tuesday August 3, laboratory analysts will load and set up the on-board laboratory. On Sunday August 8, seven additional sampling crew members, the two laboratory analysts, and Donald Anderson and Elvira Martinez from EPA will board the ship.

These individuals will also receive a health and safety briefing and then will begin sampling. The crew will tour the sampling points and discuss the detailed health and safety considerations (e.g., the hazards associated with each sampling point, related personal protective equipment, and evacuation requirements). If conditions exist which are different than those anticipated, modifications will be made in consultation with EPA and Star personnel. If necessary, additional equipment and glassware will be obtained. A detailed schedule of the activities for the sampling episode is provided in Appendix C.

4.3 Field Sampling Activities

On board the Star, the two members of the sampling crew designated to set up sampling equipment, will meet with cruise vessel personnel to determine whether samples can be collected at each of the planned sampling points. Upon making the decision to collect samples, the descriptions of the proposed sampling points will be updated, if necessary, in consultation with EPA and cruise vessel personnel. If necessary, additional equipment and glassware will be obtained. The revised description shall include:

- A sample point description and collection procedure for each sample point;
- A list of the sample fractions to be collected at each point:
- A list of potential physical hazards (such as pH, temperature, and potentially hazardous equipment);
- A list of potential chemical hazards associated with each sample point; and
- A list of proposed health and safety procedures.

Prior to sampling, the crew chief will also notify the Health and Safety Coordinator (Matt Stein, Chantilly, VA) of any revised sampling activity descriptions along with recommended revisions to the proposed health and safety procedures. Together, they will review the proposed health and safety procedures, incorporate specific changes indicated by the Health and Safety Coordinator, and gain approval for sampling from the Health and Safety Coordinator before proceeding with sampling activities.

Sample fractions collected will be labeled, sealed, and placed in coolers for shipment to the laboratory once the cruise vessel docks. The Traffic Report forms will be completed and placed in plastic sleeves inside the coolers. The coolers will then be transported to one of the laboratory analytical contractor's Juneau laboratory or for continued shipment via Federal Express office to the Sample Contro Center laboratories. Because of the very short sample holding times for microbiologicals, BOD_5 (note that not all BOD_5 samples will be analyzed on board), and SS, an on-board laboratory will be used for analysis of these samples. At the conclusion of the sampling episode, the sampling equipment will be prepared for return shipping.

The crew chief will confirm the laboratories used for analysis and communicate the number of samples being collected. The crew chief will also contact laboratories after shipping the samples to communicate shipping information.

4.4 Logistics

This section of the sampling plan summarizes cruise vessel contacts, analytical laboratory contacts and addresses, and sampling team personnel and support functions.

Cruise Ship Contacts

Randall R. Fiebrandt. P.E.
Director, Environmental Operations
Norwegian Cruise Line/Orient Lines
7665 Corporate Center Dr.
Miami, FL 33126
(305) 436-4956

Eric J. Wolff
Manager Environmental Management Systems
Norwegian Cruise Line/Orient Lines
(305) 436-4256

Klaus Myklebust
Environmental Officer
Norwegian Star

Chief Engineer
Norwegian Star

EPA Contacts

Don Anderson
Engineering and Analysis Division
U.S. Environmental Protection Agency
Ariel Rios Building
1200 Pennsylvania Avenue, NW
Mail Code 4303T
Washington, D.C. 20460
(202) 566-1021

Elizabeth Kim
Office of Wetlands, Oceans, and Watersheds
U.S. Environmental Protection Agency
Ariel Rios Building
1200 Pennsylvania Avenue, NW
Mail Code 4504T
Washington, D.C. 20460
(202) 566-1270

Sample Control Center

Erin Salo
Sample Control Center
6101 Stevenson Ave.
Fifth Floor
Alexandria, VA 22304
703-461-2350
703-461-8056 (fax)

Analytical Laboratories

Classical Wet Chemistry and Metals
Q Biochem (QBC)
1401 Municipal Road, NW
Roanoke, VA 24012
(540) 265-7211
(540) 563-4866
Contact: Cheryl Daniel

Saturday delivery to:
3875 Thirlane Road
Roanoke, VA 24019

Volatile and Semivolatile Organics
Ecology & Environment, Inc. (E&E)
4493 Walden Avenue
Lancaster, NY 14086
(716) 685-8080
(716) 685-0852
Contact: Caryn Wojtowicz

Pesticides
Pacific Analytical Inc.
6056 Corte del Cedro
Carlsbad, CA 92009
(760) 496-2200
(760) 931-9479
Contact: Steve Parsons

Dioxins/Furans and PCBs
Axys Analytical Services, Ltd.
2045 Mills Road West
Sidney, BC V8L 3S8
CANADA
(250) 655-5800
(250) 655-5811
Contact: Dr. Laurie Phillips

Available Cyanide
Bayer Polymers LLC
HSE Testing Laboratory
100 Bayer Rd. Building 8
Pittsburgh, PA 15205
(412) 777-4803
Contact: Dr. Carl Thompson

Microbiologicals, BOD_5, and Settleable Solids
Analytica Alaska, Inc.
5438 Shaune Drive
Juneau, AK 99801
(907) 780-6668
(907) 456-3116
Contact: David Wetzel

Eatern Research Group Contacts

Debbie Falatko (Project Manager) - Chemical Engineer
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Eastern Research Group, Inc.
14555 Avion Parkway, Suite 200
Chantilly, VA 20151
(703) 633-1600

Freight Forwarders

Federal Express
9203 Bonnett Way
Juneau, Alaska 99801
General Information (800) 238-5355
Weekday Hours: 7:30 am to 5 pm
Last Express Drop-off: 8:30 am, no Sat pickup

Federal Express (Drop Off):
Mail Boxes Etc.
125 Main Street
Ketchikan, AK 99901
(907) 247-2705
(907) 247-2707 (fax)
Drop-off by 9:30am, M-F

Skagway Air
General Information (907) 983-2218

Alaska Airlines Goldstreak Air Cargo
General Information (800) 634-7113

Courier Services

To be determined.

5.0 SAMPLE SHIPMENT

All sample packages will be labeled with standard address labels. All samples will be tracked using Traffic Report forms. Custody will be maintained by the crew chief from sample collection through shipment (or transfer to one of the contrator's analytical on-board laboratory).

All samples will be packaged and shipped in accordance with DOT or IATA regulations. The general IATA packaging requirements for air shipment are as follows:

- "Inner packaging must be so packed, secured or cushioned as to prevent their breakage or leakage and so as to control their movement within the outer packaging during normal conditions of transport. Cushioning material must not react dangerously with the contents of the inner packaging. Any leakage of the contents must not substantially impair the protective properties of the cushioning material. Unless otherwise provided in this paragraph or in the Packing Instructions, liquids in Classes, 3, 4, 5, 6, or 8 of Packing Groups I or II in glass or earthenware inner packaging, must be packaged using material capable of absorbing the liquid. Absorbent material must not react dangerously with the liquid. Absorbent material is not required...." (IATA Dangerous Goods Regulations, 5.0.16).

- "When filling receptacles for liquids, sufficient ullage (outage) must be left to ensure that neither leakage nor permanent distortion of the receptacle will occur as a result of an expansion of the liquid caused by temperatures likely to prevail during transport. Liquids must not completely fill a receptacle at a temperature of 55°C (130°F)." (IATA Dangerous Goods Regulations, 5.0.12).

The packing and labeling procedures in the following subsections may be used for non-hazardous samples. Hazardous samples will be identified based on consultation with the hazardous shipments contact, and appropriate hazardous shipping procedures will be followed. Based on process considerations, samples collected on board large cruise vessels will not be classified as IATA dangerous goods.

5.1 Sample Set Preparation

Samples are collected as a series of "fractions," or bottles designated for particular analyses requiring the same preservation. The comprehensive water sample set consists of sample fractions for all pollutants listed in Section 3.2 collected over a 24-hour period.

At the end of the compositing period, sampling points SP-1, SP-2, SP-3, SP-4, SP-5, and SP-7/SP-8 will include approximately 20 liters of sample collected in two 10-L composite sample containers. The content of the composite sample containers will be thoroughly mixed using a third, clean composite sample container. To perform this mixing, half of each composite sample container will be poured into the third jar then the two half-full composite sample containers will be combined into one. Repeat this process two more times to ensure proper mixing. Sample fractions will be poured from the composite sample containers into individual sample bottles using the following procedure.

- Swirl and shake the composite sample container to re-suspend settled solids;
- Fill each sample bottle to about ½ of its empty volume;
- Mix the remaining volume in the composite sample container; and
- In reverse order, fill the sample bottles.

Cyanide samples will be composited separately from the other pollutant parameters. Up to four grab samples during each 24-hour sampling period will be collected for cyanide analyses in separate 500 mL or one liter amber glass jars and preserved according to Table 3-2. After the sampling period ends, the four 500 mL or one liter grab samples will be composited by mixing in a sampling point-specific composite jar and then poured into separate bottles for analysis of total and available cyanide.

HEM/SGT-HEM samples will be composited during sample collection by collecting the individual grab samples directly into the sample containers. For example, at sampling points where a total of four grab samples will be collected during a 24-hour sampling period, approximately one-fourth (250 mL) of the sample containers will be filled when each of the four grab samples are collected, resulting in full sample containers at the end of each sampling period.

5.2 Sample Packing

All samples from the Star will be packed according to the following guidelines:

1. Tighten the lid on each filled sample bottle, being careful not to overtighten the lid. Clean the sample bottle with a cloth rag or paper towel.

2. Label each sample bottle. (Sample labeling is discussed in Section 3.6 of this document.) Cover the label with clear tape to protect this information, if needed.

3. Wrap each glass sample bottle with “bubble wrap”. The bubble wrap must fit snugly and completely cover the sample bottle. Each "bubble-wrapped" container and plastic container must then be enclosed in an individual sealable plastic freezer bag.

4. Place two garbage bags inside each other in a cooler.

5. Place sample bottles in garbage bags in the cooler with proper end up and tie bag closed.

6. Arrange sealed plastic freezer bags filled with ice (or chemical ice) on top of the sample bottles (if ice is to be used as a preservative). Put at least 4 x ½ gallons of ice (4 x 2.5 lbs of ice) in each large cooler and 2 x ½ gallons of ice (2 x 2.5 lbs of ice) in each small cooler. More ice should be used when ambient temperatures are very high. The ice should be placed inside the second garbage bag. Tie the second garbage bag closed. Any additional free space should be filled with packing material so that the sample containers will not shift during shipment.

7. Seal the Traffic Report form in a plastic sleeve and tape securely to the inside of the cooler lid.

8. Place a "Return to ..." label on the inside of the cooler lid.

9. Close cooler.

10. Make several wraps with strapping tape around the cooler perpendicular to the seal to ensure that the lid will remain closed if the latch is accidentally released or damaged.

11. Tape the cooler drain plug so it will not open.

12. Place a completed address label on the lid of the cooler including name, address, and telephone number of the receiving laboratory and the return address and telephone number of the shipper.

6.0 SHIP-SPECIFIC HEALTH AND SAFETY PROCEDURES

This section specifies the health and safety procedures and practices to be used by the sampling team during sampling on board Norwegian Cruise Line's Star. This section is a supplement to the General Health and Safety Plan for Large Cruise Ships, and provides general health and safety information for this sampling episode. The sampling team is obligated to follow all safety protocols delineated in the General Health and Safety Plan for Large Cruise Ships and the procedures specified in this section.

Sampling personnel are required to wear nonskid, steel-toed shoes, long sleeves, and long pants at all times while sampling, preserving, or otherwise handling samples. Nitrile gloves and safety glasses with side shields (or goggles) must be worn when collecting and preserving samples. Contact lenses may be worn with goggles. Dust masks or face shields are optional equipment at sampling points unless there is a splash potential (i.e., sampling port is located at sampler's waist level or higher). Hearing protection will be worn in all ship machinery areas and other ship spaces where hearing protection requirements are posted. Heat resistant gloves and Tyvek suits will be worn as needed at each sampling station for protection from splash or hot samples, or as required by ship safety protocol. Ship supervisors in sampling areas will be notified prior to sampling. Sampling personnel will keep MSDSs for all chemical preservatives in the sampling file box for easy access. Sampling crew will not enter confined spaces (as defined by 29 CFR 1910.146) with any portion of the body.

Prior to the start of sampling activities, sampling crew personnel will attend a formal health and safety briefing conducted by the Star's Chief Environmental Officer. The briefing will address all health and safety issues for personnel working on the ship, including special signals, alarm systems, evacuation routes and assembly points, emergency phone numbers and procedures, and the location of the on-board medical clinic. In addition, the briefing tour will include a tour of the sampling areas, during which the sampling team will be advised of any sampling point-specific health and safety hazards, as well as the locations of to emergency eyewashes and safety showers. Relevant phone numbers include x41222 for medical, x11222 for the bridge, x4040 for the engine control room, and x8817 for the environmental officer.

Before sampling at any point, crew members will locate the nearest eyewash and safety shower. If an eyewash in not available in the immediate vicinity of the sampling area, a portable eyewash unit will be stationed in that area for use during sampling and sample preservation.

6.1 Sampling Point-Specific Safety Procedures

All sampling team members will be advised of any sampling point-specific safety protocol during the formal on-ship health and safety briefing. A summary of all the known sampling point-specific safety hazards is provided in Table 6-1 along with the personal protective equipment (PPE) required at each sampling point. The sampling crew health and safety officer (HSO) and the sampling team will inspect each sampling point area to identify unique or additional hazards not already covered in this plan or during the formal health and safety briefing. If additional hazards are found, the sampling crew will be informed of each hazard and required control measures prior to the start of work. Where identified hazards may affect the ship's personnel, the HSO will notify an appropriate member of the ship's crew.

6.1.1 Physical Hazards

The use of narrow walkways or steep stairs may be necessary to access sampling points. Prior to use, the walkways and stairs will be inspected. If platforms are defective (e.g., rails missing or unsecured walkways), ship personnel will be notified immediately. Sampling personnel will not use these access points until appropriate control measures have been implemented or an alternate route is established. Crew members must have one hand free to hold the railing when using narrow stairways. Samplers will not block aisles, walkways, or areas where ship's personnel routinely work in order to access the sampling point unless it is unavoidable, and the ship's crew is notified.

Noise will be a hazard on certain areas of the ship. Hearing protection will be used by the sampling team where required by the ship, when sampling members are having trouble hearing or being heard when standing three feet or less away from another person, or when deemed necessary by the HSO. Sampling personnel will receive training on the proper use and fitting of hearing protection in the off-ship health and safety training.

6.1.2 Thermal Hazards

Heat stress may be a concern in the Star sampling episode. Sampling crew members will potentially become exposed to hot/humid sampling environments as well as thermal or radiant heat generated by equipment. Section 7.0 of the General Health and Safety Plan for Large Cruise Ships should be referred to for specific directions on heat stress prevention, treatment, and monitoring. However, temperatures in the engine rooms are expected to be comfortable at 20°C to 22°C.

None of the wastewater sampling points are expected to be hot, since samples will be collected at the outlet from collection/holding tanks. One possible exception is the dried wastewater treatment sludge, which is approximately 50°C at the start of the sludge conveyor to the incinerator, but approximately 20°C at the inlet to the incinerator.

6.1.3 Chemical Hazards

The only chemical hazards expected are chemicals used for the preservation of samples. All sampling crew will be advised of any potential chemical hazards at each sampling point as well as any special PPE recommendations during the formal health and safety briefing on board. If the sampling point is above waist height, a face shield or goggles must be worn during sample collection. In order to avoid the ingestion of chemicals, sampling crew members will be required to wash hands thoroughly before eating, drinking, or smoking. Sampling personnel will not be permitted to enter areas where the ship has determined that respiratory protection equipment is necessary to protect against inhalation hazards.

6.1.4 Biological Hazards

Domestic sewage may potentially contain blood or other potentially infectious material defined under OSHA's blood born pathogen regulations (29 CFR 1910.1030). Typically, blood will not be present in domestic sewage unless it comes directly from the infirmary area of the ship. OSHA recognizes that contact with raw sewage poses a number of health risks, but does not consider contact with diluted raw sewage is an exposure route for blood born pathogens. Nonetheless, sample crew members who sample the domestic sewage portion of the wastewater treatment system are to be aware of the potential danger and will be outfitted with proper PPE (i.e., nitrile gloves, tyvek suites, splash goggles) to minimize the chance for exposure. PPE required or recommended at each sampling point is described in Table 6-1. Sampling crew members are also recommended to have current Tetanus and Hepatitis A and B immunizations to protect themselves against potential biological hazards.

Table 6-1

Sampling Point-Specific Safety Procedures
Norwegian Star

Sampling Point Number	Sampling Point Description	Physical Hazards (a)	Personal Protective Equipment (b)
SP-1	Galley wastewater	None anticipated	None
SP-2	Food pulper wastewater	None anticipated	None
SP-3	Accommodations wastewater	None anticipated	None
SP-4	Laundry wastewater	None anticipated	None
SP-5	Influent to wastewater treatment system	None anticipated	None
SP-6	Influent to UV	None anticipated	None
SP-7/SP-8	Effluent from wastewater treatment system	None anticipated	None
SP-9	Dried Wastewater Treatment Sludge	None anticipated	None
SP-10	Incinerator ash	Potentially hot sample	Possible heat resistant gloves
SP-11	Source water	None anticipated	None
SP-12	Trip blank	None anticipated	None
SP-13	Equipment blank	None anticipated	None

(a) Additional physical hazards, if any, will be identified during the formal on-ship health and safety briefing. Updates to this table should be made as found.
(b) Splash protection (tyvek and face shield) required if sampling port is waist high or above.

7.0 REFERENCES

1. Eastern Research Group, Inc., Quality Assurance Project Plan for Rulemaking Support for Large Cruise Ships in Alaska Water. March 2004.

Appendix A

LIST OF CONSTITUENTS FOR ANALYSIS

Table A-1

List of Constituents for Analysis - Volatile Organic Analytes

CAS Number	Common Name	Technique	Method
107131	ACRYLONITRILE	GCMS	1624
71432	BENZENE	GCMS	1624
75274	BROMODICHLOROMETHANE	GCMS	1624
74839	BROMOMETHANE	GCMS	1624
75150	CARBON DISULFIDE	GCMS	1624
107142	CHLOROACETONITRILE	GCMS	1624
108907	CHLOROBENZENE	GCMS	1624
75003	CHLOROETHANE	GCMS	1624
67663	CHLOROFORM	GCMS	1624
74873	CHLOROMETHANE	GCMS	1624
10061015	CIS-1,3-DICHLOROPROPENE	GCMS	1624
4170303	CROTONALDEHYDE	GCMS	1624
124481	DIBROMOCHLOROMETHANE	GCMS	1624
74953	DIBROMOMETHANE	GCMS	1624
60297	DIETHYL ETHER	GCMS	1624
107120	ETHYL CYANIDE	GCMS	1624
97632	ETHYL METHACRYLATE	GCMS	1624
100414	ETHYLBENZENE	GCMS	1624
74884	IODOMETHANE	GCMS	1624
78831	ISOBUTYL ALCOHOL	GCMS	1624
108383	M-XYLENE	GCMS	1624
80626	METHYL METHACRYLATE	GCMS	1624
75092	METHYLENE CHLORIDE	GCMS	1624
1-952	O+P XYLENE	GCMS	1624
127184	TETRACHLOROETHENE	GCMS	1624
56235	TETRACHLOROMETHANE	GCMS	1624
108883	TOLUENE	GCMS	1624
156605	TRANS-1,2-DICHLOROETHENE	GCMS	1624
10061026	TRANS-1,3-DICHLOROPROPENE	GCMS	1624
110576	TRANS-1,4-DICHLORO-2-BUTENE	GCMS	1624
75252	TRIBROMOMETHANE	GCMS	1624
79016	TRICHLOROETHENE	GCMS	1624
75694	TRICHLOROFLUOROMETHANE	GCMS	1624
108054	VINYL ACETATE	GCMS	1624
75014	VINYL CHLORIDE	GCMS	1624
75343	1,1-DICHLOROETHANE	GCMS	1624
75354	1,1-DICHLOROETHENE	GCMS	1624

Table A-1 (Continued)

CAS Number	Common Name	Technique	Method
71556	1,1,1-TRICHLOROETHANE	GCMS	1624
630206	1,1,1,2-TETRACHLOROETHANE	GCMS	1624
79005	1,1,2-TRICHLOROETHANE	GCMS	1624
79345	1,1,2,2-TETRACHLOROETHANE	GCMS	1624
106934	1,2-DIBROMOETHANE	GCMS	1624
107062	1,2-DICHLOROETHANE	GCMS	1624
78875	1,2-DICHLOROPROPANE	GCMS	1624
96184	1,2,3-TRICHLOROPROPANE	GCMS	1624
126998	1,3-BUTADIENE, 2-CHLORO	GCMS	1624
142289	1,3-DICHLOROPROPANE	GCMS	1624
123911	1,4-DIOXANE	GCMS	1624
78933	2-BUTANONE	GCMS	1624
110758	2-CHLOROETHYLVINYL ETHER	GCMS	1624
591786	2-HEXANONE	GCMS	1624
67641	2-PROPANONE	GCMS	1624
107186	2-PROPEN-1-OL	GCMS	1624
107028	2-PROPENAL	GCMS	1624
126987	2-PROPENENITRILE, 2-METHYL-	GCMS	1624
107051	3-CHLOROPROPENE	GCMS	1624
108101	4-METHYL-2-PENTANONE	GCMS	1624

57 VOLATILE ANALYTES

Table A-2

List of Constituents for Analysis -
Semivolatile Organic Analytes

CAS Number	Common Name	Technique	Method
83329	ACENAPHTHENE	GCMS	1625
208968	ACENAPHTHYLENE	GCMS	1625
98862	ACETOPHENONE	GCMS	1625
98555	ALPHA-TERPINEOL	GCMS	1625
62533	ANILINE	GCMS	1625
137177	ANILINE, 2,4,5-TRIMETHYL-	GCMS	1625
120127	ANTHRACENE	GCMS	1625
140578	ARAMITE	GCMS	1625
82053	BENZANTHRONE	GCMS	1625
108985	BENZENETHIOL	GCMS	1625
92875	BENZIDINE	GCMS	1625
56553	BENZO(A)ANTHRACENE	GCMS	1625
50328	BENZO(A)PYRENE	GCMS	1625
205992	BENZO(B)FLUORANTHENE	GCMS	1625
191242	BENZO(GHI)PERYLENE	GCMS	1625
207089	BENZO(K)FLUORANTHENE	GCMS	1625
65850	BENZOIC ACID	GCMS	1625
1689845	BENZONITRILE, 3,5-DIBROMO-4-HYDROXY-	GCMS	1625
100516	BENZYL ALCOHOL	GCMS	1625
91598	BETA-NAPHTHYLAMINE	GCMS	1625
92524	BIPHENYL	GCMS	1625
92933	BIPHENYL, 4-NITRO	GCMS	1625
111911	BIS(2-CHLOROETHOXY)METHANE	GCMS	1625
111444	BIS(2-CHLOROETHYL) ETHER	GCMS	1625
108601	BIS(2-CHLOROISOPROPYL) ETHER	GCMS	1625
117817	BIS(2-ETHYLHEXYL) PHTHALATE	GCMS	1625
85687	BUTYL BENZYL PHTHALATE	GCMS	1625
86748	CARBAZOLE	GCMS	1625
218019	CHRYSENE	GCMS	1625
7700176	CROTOXYPHOS	GCMS	1625
84742	DI-N-BUTYL PHTHALATE	GCMS	1625
117840	DI-N-OCTYL PHTHALATE	GCMS	1625
621647	DI-N-PROPYLNITROSAMINE	GCMS	1625
53703	DIBENZO(A,H)ANTHRACENE	GCMS	1625
132649	DIBENZOFURAN	GCMS	1625
132650	DIBENZOTHIOPHENE	GCMS	1625

Table A-2 (Continued)

CAS Number	Common Name	Technique	Method
84662	DIETHYL PHTHALATE	GCMS	1625
131113	DIMETHYL PHTHALATE	GCMS	1625
67710	DIMETHYL SULFONE	GCMS	1625
101848	DIPHENYL ETHER	GCMS	1625
122394	DIPHENYLAMINE	GCMS	1625
882337	DIPHENYLDISULFIDE	GCMS	1625
76017	ETHANE, PENTACHLORO-	GCMS	1625
62500	ETHYL METHANESULFONATE	GCMS	1625
96457	ETHYLENETHIOUREA	GCMS	1625
206440	FLUORANTHENE	GCMS	1625
86737	FLUORENE	GCMS	1625
118741	HEXACHLOROBENZENE	GCMS	1625
87683	HEXACHLOROBUTADIENE	GCMS	1625
77474	HEXACHLOROCYCLOPENTADIENE	GCMS	1625
67721	HEXACHLOROETHANE	GCMS	1625
1888717	HEXACHLOROPROPENE	GCMS	1625
142621	HEXANOIC ACID	GCMS	1625
193395	INDENO(1,2,3-CD)PYRENE	GCMS	1625
78591	ISOPHORONE	GCMS	1625
120581	ISOSAFROLE	GCMS	1625
475207	LONGIFOLENE	GCMS	1625
569642	MALACHITE GREEN	GCMS	1625
72333	MESTRANOL	GCMS	1625
91805	METHAPYRILENE	GCMS	1625
66273	METHYL METHANESULFONATE	GCMS	1625
124185	N-DECANE	GCMS	1625
629970	N-DOCOSANE	GCMS	1625
112043	N-DODECANE	GCMS	1625
112958	N-EICOSANE	GCMS	1625
630013	N-HEXACOSANE	GCMS	1625
544763	N-HEXADECANE	GCMS	1625
924163	N-NITROSODI-N-BUTYLAMINE	GCMS	1625
55185	N-NITROSODIETHYLAMINE	GCMS	1625
62759	N-NITROSODIMETHYLAMINE	GCMS	1625
86306	N-NITROSODIPHENYLAMINE	GCMS	1625
10595956	N-NITROSOMETHYLETHYLAMINE	GCMS	1625
614006	N-NITROSOMETHYLPHENYLAMINE	GCMS	1625
59892	N-NITROSOMORPHOLINE	GCMS	1625
100754	N-NITROSOPIPERIDINE	GCMS	1625

Table A-2 (Continued)

CAS Number	Common Name	Technique	Method
630024	N-OCTACOSANE	GCMS	1625
593453	N-OCTADECANE	GCMS	1625
646311	N-TETRACOSANE	GCMS	1625
629594	N-TETRADECANE	GCMS	1625
638686	N-TRIACONTANE	GCMS	1625
68122	N,N-DIMETHYLFORMAMIDE	GCMS	1625
91203	NAPHTHALENE	GCMS	1625
98953	NITROBENZENE	GCMS	1625
90040	O-ANISIDINE	GCMS	1625
95487	O-CRESOL	GCMS	1625
95534	O-TOLUIDINE	GCMS	1625
95794	O-TOLUIDINE, 5-CHLORO-	GCMS	1625
106478	P-CHLOROANILINE	GCMS	1625
106445	P-CRESOL	GCMS	1625
99876	P-CYMENE	GCMS	1625
60117	P-DIMETHYLAMINOAZOBENZENE	GCMS	1625
100016	P-NITROANILINE	GCMS	1625
608935	PENTACHLOROBENZENE	GCMS	1625
87865	PENTACHLOROPHENOL	GCMS	1625
700129	PENTAMETHYLBENZENE	GCMS	1625
198550	PERYLENE	GCMS	1625
62442	PHENACETIN	GCMS	1625
85018	PHENANTHRENE	GCMS	1625
108952	PHENOL	GCMS	1625
534521	PHENOL, 2-METHYL-4,6-DINITRO-	GCMS	1625
92842	PHENOTHIAZINE	GCMS	1625
23950585	PRONAMIDE	GCMS	1625
129000	PYRENE	GCMS	1625
110861	PYRIDINE	GCMS	1625
108462	RESORCINOL	GCMS	1625
94597	SAFROLE	GCMS	1625
7683649	SQUALENE	GCMS	1625
100425	STYRENE	GCMS	1625
95158	THIANAPHTHENE	GCMS	1625
62555	THIOACETAMIDE	GCMS	1625
492228	THIOXANTHE-9-ONE	GCMS	1625
95807	TOLUENE, 2,4-DIAMINO-	GCMS	1625
217594	TRIPHENYLENE	GCMS	1625
20324338	TRIPROPYLENEGLYCOL METHYL ETHER	GCMS	1625

Table A-2 (Continued)

CAS Number	Common Name	Technique	Method
694804	1-BROMO-2-CHLOROBENZENE	GCMS	1625
108372	1-BROMO-3-CHLOROBENZENE	GCMS	1625
121733	1-CHLORO-3-NITROBENZENE	GCMS	1625
1730376	1-METHYLFLUORENE	GCMS	1625
832699	1-METHYLPHENANTHRENE	GCMS	1625
134327	1-NAPHTHYLAMINE	GCMS	1625
605027	1-PHENYLNAPHTHALENE	GCMS	1625
96128	1,2-DIBROMO-3-CHLOROPROPANE	GCMS	1625
95501	1,2-DICHLOROBENZENE	GCMS	1625
122667	1,2-DIPHENYLHYDRAZINE	GCMS	1625
87616	1,2,3-TRICHLOROBENZENE	GCMS	1625
634366	1,2,3-TRIMETHOXYBENZENE	GCMS	1625
120821	1,2,4-TRICHLOROBENZENE	GCMS	1625
95943	1,2,4,5-TETRACHLOROBENZENE	GCMS	1625
1464535	1,2,3,4-DIEPOXYBUTANE	GCMS	1625
96231	1,3-DICHLORO-2-PROPANOL	GCMS	1625
541731	1,3-DICHLOROBENZENE	GCMS	1625
291214	1,3,5-TRITHIANE	GCMS	1625
106467	1,4-DICHLOROBENZENE	GCMS	1625
100254	1,4-DINITROBENZENE	GCMS	1625
130154	1,4-NAPHTHOQUINONE	GCMS	1625
2243621	1,5-NAPHTHALENEDIAMINE	GCMS	1625
615225	2-(METHYLTHIO)BENZOTHIAZOLE	GCMS	1625
91587	2-CHLORONAPHTHALENE	GCMS	1625
95578	2-CHLOROPHENOL	GCMS	1625
2027170	2-ISOPROPYLNAPHTALENE	GCMS	1625
120752	2-METHYLBENZOTHIOAZOLE	GCMS	1625
91576	2-METHYLNAPHTHALENE	GCMS	1625
88744	2-NITROANILINE	GCMS	1625
88755	2-NITROPHENOL	GCMS	1625
612942	2-PHENYLNAPHTALENE	GCMS	1625
109068	2-PICOLINE	GCMS	1625
243174	2,3-BENZOFLUORENE	GCMS	1625
608275	2,3-DICHLOROANILINE	GCMS	1625
3209221	2,3-DICHLORONITROBENZENE	GCMS	1625
58902	2,3,4,6-TETRACHLOROPHENOL	GCMS	1625
933755	2,3,6-TRICHLOROPHENOL	GCMS	1625
120832	2,4-DICHLOROPHENOL	GCMS	1625
105679	2,4-DIMETHYLPHENOL	GCMS	1625

Table A-2 (Continued)

CAS Number	Common Name	Technique	Method
51285	2,4-DINITROPHENOL	GCMS	1625
121142	2,4-DINITROTOLUENE	GCMS	1625
95954	2,4,5-TRICHLOROPHENOL	GCMS	1625
88062	2,4,6-TRICHLOROPHENOL	GCMS	1625
719222	2,6-DI-TER-BUTYL-P-BENZOQUINONE	GCMS	1625
99309	2,6-DICHLORO-4-NITROANILINE	GCMS	1625
87650	2,6-DICHLOROPHENOL	GCMS	1625
606202	2,6-DINITROTOLUENE	GCMS	1625
56495	3-METHYLCHOLANTHRENE	GCMS	1625
99092	3-NITROANILINE	GCMS	1625
91941	3,3'-DICHLOROBENZIDINE	GCMS	1625
119904	3,3'-DIMETHOXYBENZIDINE	GCMS	1625
1576676	3,6-DIMETHYLPHENANTHRENE	GCMS	1625
92671	4-AMINOBIPHENYL	GCMS	1625
101553	4-BROMOPHENYL PHENYL ETHER	GCMS	1625
89634	4-CHLORO-2-NITROANILINE	GCMS	1625
59507	4-CHLORO-3-METHYLPHENOL	GCMS	1625
7005723	4-CHLOROPHENYLPHENYL ETHER	GCMS	1625
100027	4-NITROPHENOL	GCMS	1625
101144	4,4'-METHYLENEBIS(2-CHLOROANILINE)	GCMS	1625
203546	4,5-METHYLENE PHENANTHRENE	GCMS	1625
99558	5-NITRO-O-TOLUIDINE	GCMS	1625
57976	7,12-DIMETHYLBENZ(A)ANTHRACENE	GCMS	1625

176 STANDARD SEMIVOLATILE ANALYTES

Table A-3

List of Constituents for Analysis - Metal Analytes

CAS Number	Common Name	Technique	Method
7429905	ALUMINUM	ICP	1620
7440360	ANTIMONY	FURNAA	1620
7440382	ARSENIC	FURNAA	1620
7440393	BARIUM	ICP	1620
7440417	BERYLLIUM	ICP	1620
7440428	BORON	ICP	1620
7440439	CADMIUM	ICP	1620
7440702	CALCIUM	ICP	1620
7440473	CHROMIUM	ICP	1620
7440484	COBALT	ICP	1620
7440508	COPPER	ICP	1620
7439896	IRON	ICP	1620
7439921	LEAD	ICP	1620
7439954	MAGNESIUM	ICP	1620
7439965	MANGANESE	ICP	1620
7439976	MERCURY	CVAA	1620
7439987	MOLYBDENUM	ICP	1620
7440020	NICKEL	ICP	1620
7782492	SELENIUM	FURNAA	1620
7440224	SILVER	ICP	1620
7440235	SODIUM	ICP	1620
7440280	THALLIUM	FURNAA	1620
7440315	TIN	ICP	1620
7440326	TITANIUM	ICP	1620
7440622	VANADIUM	ICP	1620
7440655	YTTRIUM	ICP	1620
7440666	ZINC	ICP	1620

27 METALS ANALYTES

Table A-4

List of Constituents for Analysis - Organo-Phosphorous Pesticide Analytes

CAS Number	Common Name	Technique	Method
2642719	AZINPHOS ETHYL	GC-FPD	1657
86500	AZINPHOS METHYL	GC-FPD	1657
470906	CHLORFEVINPHOS	GC-FPD	1657
2921882	CHLOROPYRIFOS	GC-FPD	1657
56724	COUMAPHOS	GC-FPD	1657
7700176	CROTOXYPHOS	GC-FPD	1657
78488	DEF	GC-FPD	1657
8065483	DEMETON	GC-FPD	1657
8065483A	DEMETON A	GC-FPD	1657
8065483B	DEMETON B	GC-FPD	1657
333415	DIAZINON	GC-FPD	1657
97176	DICHLOFENTHION	GC-FPD	1657
62737	DICHLORVOS	GC-FPD	1657
141662	DICROTOPHOS	GC-FPD	1657
60515	DIMETHOATE	GC-FPD	1657
78342	DIOXATHION	GC-FPD	1657
298044	DISULFOTON	GC-FPD	1657
2104645	EPN	GC-FPD	1657
563122	ETHION	GC-FPD	1657
13194484	ETHOPROP	GC-FPD	1657
52857	FAMPHUR	GC-FPD	1657
115902	FENSULFOTHION	GC-FPD	1657
55389	FENTHION	GC-FPD	1657
680319	HEXAMETHYLPHOSPHORAMIDE	GC-FPD	1657
21609905	LEPTOPHOS	GC-FPD	1657
121755	MALATHION	GC-FPD	1657
150505	MERPHOS	GC-FPD	1657
10265926	METHAMIDOPHOS	GC-FPD	1657
5598130	METHYL CHLORPYRIFOS	GC-FPD	1657
298000	METHYL PARATHION	GC-FPD	1657
953173	METHYL TRITHION	GC-FPD	1657
7786347	MEVINPHOS	GC-FPD	1657
6923224	MONOCROTOPHOS	GC-FPD	1657
300765	NALED	GC-FPD	1657
56382	PARATHION (ETHYL)	GC-FPD	1657
298022	PHORATE	GC-FPD	1657
732116	PHOSMET	GC-FPD	1657
13171216	PHOSPHAMIDON	GC-FPD	1657
297994	PHOSPHAMIDON E	GC-FPD	1657
23783984	PHOSPHAMIDON Z	GC-FPD	1657

Table A-4 (continued)

CAS Number	Common Name	Technique	Method
299843	RONNEL	GC-FPD	1657
3689245	SULFOTEPP	GC-FPD	1657
35400432	SULPROFOS (BOLSTAR)	GC-FPD	1657
107493	TEPP	GC-FPD	1657
13071799	TERBUFOS	GC-FPD	1657
22248799	TETRACHLORVINPHOS	GC-FPD	1657
34643464	TOKUTHION	GC-FPD	1657
52686	TRICHLORFON	GC-FPD	1657
327980	TRICHLORONATE	GC-FPD	1657
78308	TRICRESYLPHOSPHATE	GC-FPD	1657
512561	TRIMETHYLPHOSPHATE	GC-FPD	1657

51 ORGANO-PHOSPHORUS PESTICIDE ANALYTES

Table A-5

List of Constituents for Analysis - Organo-Halide Pesticide Analytes

CAS Number	Common Name	Technique	Method
30560191	ACEPHATE	GC-HSD	1656
50594666	ACIFIUORFEN	GC-HSD	1656
15972608	ALACHLOR	GC-HSD	1656
309002	ALDRIN	GC-HSD	1656
1912249	ATRAZINE	GC-HSD	1656
1861401	BENFLURALIN (BENEFIN)	GC-HSD	1656
319846	α-BHC	GC-HSD	1656
319857	β-BHC	GC-HSD	1656
58899	γ-BHC (LINDANE)	GC-HSD	1656
319868	δ-BHC	GC-HSD	1656
314409	BROMACIL	GC-HSD	1656
1689992	BROMOXYNIL OCTANOATE	GC-HSD	1656
23184669	BUTACHLOR	GC-HSD	1656
2425061	CAPTAFOL	GC-HSD	1656
133062	CAPTAN	GC-HSD	1656
786196	CARBOPHENOTHION (TRITHION)	GC-HSD	1656
57749	CHLORDANE	GC-HSD	1656
5103719	α -CHLORDANE (CIS-CHLORDANE)	GC-HSD	1656
5103742	γ -CHLORDANE (TRANS-CHLORDANE)	GC-HSD	1656
510156	CHLORBENZILATE	GC-HSD	1656
2675776	CHLORONEB (TERRANEB)	GC-HSD	1656
5836102	CHLOROPROPYLATE (ACARALATE)	GC-HSD	1656
1897456	CHLOROTHALONIL	GC-HSD	1656
96128	DBCP (DIBROMOCHLOROPROPANE)	GC-HSD	1656
1861321	DCPA (DACTHAL)	GC-HSD	1656
72548	4,4'-DDD (TDE)	GC-HSD	1656
72559	4,4'-DDE	GC-HSD	1656
50293	4,4'-DDT	GC-HSD	1656
2303164	DIALLATE (AVADEX)	GC-HSD	1656
2303164A	DIALLATE A	GC-HSD	1656
2303164B	DIALLATE B	GC-HSD	1656
117806	DICHLONE	GC-HSD	1656
115322	DICOFOL	GC-HSD	1656
60571	DIELDRIN	GC-HSD	1656
959988	ENDOSULFAN I	GC-HSD	1656
33213659	ENDOSULFAN II	GC-HSD	1656
1031078	ENDOSULFAN SULFATE	GC-HSD	1656
72208	ENDRIN	GC-HSD	1656
7421934	ENDRIN ALDEHYDE	GC-HSD	1656
53494705	ENDRIN KETONE	GC-HSD	1656
55283686	ETHALFLURALIN (SONALAN)	GC-HSD	1656
2593159	ETRIDIAZOLE	GC-HSD	1656

Table A-5 (Continued)

CAS Number	Common Name	Technique	Method
60168889	FENARIMOL (RUBIGAN)	GC-HSD	1656
76448	HEPTACHLOR	GC-HSD	1656
1024573	HEPTACHLOR EPOXIDE	GC-HSD	1656
465736	ISODRIN	GC-HSD	1656
33820530	ISOPROPALIN (PAARLAN)	GC-HSD	1656
143500	KEPONE	GC-HSD	1656
72435	METHOXYCHLOR	GC-HSD	1656
21087649	METRIBUZIN	GC-HSD	1656
2385855	MIREX	GC-HSD	1656
1836755	NITROFEN (TOK)	GC-HSD	1656
27314132	NORFLUORAZON	GC-HSD	1656
12674112	PCB-1016	GC-HSD	1656
11104282	PCB-1221	GC-HSD	1656
11141165	PCB-1232	GC-HSD	1656
53469219	PCB-1242	GC-HSD	1656
12672296	PCB-1248	GC-HSD	1656
11097691	PCB-1254	GC-HSD	1656
11096825	PCB-1260	GC-HSD	1656
82688	PCNB (PENTACHLORONITROBENZENE)	GC-HSD	1656
40487421	PENDAMETHALIN (PROWL)	GC-HSD	1656
61949766	CIS-PERMETHRIN	GC-HSD	1656
61949777	TRANS-PERMETHRIN	GC-HSD	1656
72560	PERTHANE (ETHYLAN)	GC-HSD	1656
1918167	PROPACHLOR	GC-HSD	1656
709988	PROPANIL	GC-HSD	1656
139402	PROPAZINE	GC-HSD	1656
122349	SIMAZINE	GC-HSD	1656
8001501	STROBANE	GC-HSD	1656
5902512	TERBACIL	GC-HSD	1656
5915413	TERBUTHYLAZINE	GC-HSD	1656
8001352	TOXAPHENE	GC-HSD	1656
43121433	TRIADIMEFON (BAYLETON)	GC-HSD	1656
1582098	TRIFLURALIN	GC-HSD	1656

75 ORGANO-HALIDE PESTICIDE ANALYTES

Table A-6

List of Constituents for Analysis -
Chlorinated Biphenyls Congeners

There are 209 possible congeners, 12 of which have toxicological significance (i.e., the "toxic" PCBs identified by the World Health Organization). Method 1668A can unambiguously determine 126 of the 209 congeners as separate chromatographic peaks. The remaining 83 congeners do not appear as separate peaks, but elute from the gas chromatograph in groups of 2 to 6 congeners that cannot be completely resolved by the instrumentation. Ten of the 12 "toxic" congeners are resolved, and the remaining two congeners (PCB 156 and PCB 157) elute as a congener pair. (Because PCB 156 and 157 have identical toxicity equivalency factors (TEFs), it is possible to accurately calculate PCB toxic equivalence (TEQ) based on the 12 toxic congeners.)

For reporting purposes, each sample will be associated with 126 results that represent the 126 single PCB congeners, and another 33 results that represent co-eluting congener groups for the remaining 83 congeners, for a total of 159 PCB congener "results." In addition, each sample will be associated with 10 values corresponding to the 10 possible levels of chlorination for the parent biphenyl. Each of these 10 values represents the sum of the concentrations of all of the congeners in a given level of chlorination (i.e., a total of the mon-chlorinated PCBs, a total of the di-chloro PCBs, etc.). Finally, each sample is associated with a grand total PCB value, which represents the sum of the 126 congener results plus the 33 values for the co-eluting congeners. In summary, each analysis will include 170 unique PCB results (126+33+10+1), and 11 of these results represent totals drawn from the first 159 records (126+33).

159 congeners, including the following 12 "toxic" congeners:

Common Name	Technique	Method
3,3'4,4'-TeCB	HRGCMS	1668
3,4,4',5-TeCB	HRGCMS	1668
2,3,3'4,4'-PeCB	HRGCMS	1668
2,3,4,4',5-PeCB	HRGCMS	1668
2,3'4,4',5-PeCB	HRGCMS	1668
2',3,4,4',5-PeCB	HRGCMS	1668
3,3'4,4',5-PeCB	HRGCMS	1668
2,3,3',4,4',5-HxCB	HRGCMS	1668
2,3,3'4,4',5'-HxCB	HRGCMS	1668
2,3',4,4',5,5'-HxCB	HRGCMS	1668
3,3'4,4',5,5'-HxCB	HRGCMS	1668
2,3,3',4,4',5,5'-HpCB	HRGCMS	1668

209 PCB CONGENERS

Table A-7

List of Constituents for Analysis - Dioxin and Furan Analytes

CAS Number	Common Name	Technique	Method
3268879	OCTACHLORODIBENZO-P-DIOXIN	HRGCMS	1613
39001020	OCTACHLORODIBENZOFURAN	HRGCMS	1613
35822469	1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXINS	HRGCMS	1613
67562394	1,2,3,4,6,7,8-HEPTACHLORODIBENZOFURAN	HRGCMS	1613
39227286	1,2,3,4,7,8-HEXACHLORODIBENZO-P-DIOXIN	HRGCMS	1613
70648269	1,2,3,4,7,8-HEXACHLORODIBENZOFURAN	HRGCMS	1613
55673897	1,2,3,4,7,8,9-HEPTACHLORODIBENZOFURAN	HRGCMS	1613
57653857	1,2,3,6,7,8-HEXACHLORODIBENZO-P-DIOXIN	HRGCMS	1613
57117449	1,2,3,6,7,8-HEXACHLORODIBENZOFURAN	HRGCMS	1613
40321764	1,2,3,7,8-PENTACHLORODIBENZO-P-DIOXIN	HRGCMS	1613
57117416	1,2,3,7,8-PENTACHLORODIBENZOFURAN	HRGCMS	1613
19408743	1,2,3,7,8,9-HEXACHLORODIBENZO-P-DIOXIN	HRGCMS	1613
72918219	1,2,3,7,8,9-HEXACHLORODIBENZOFURAN	HRGCMS	1613
60851345	2,3,4,6,7,8-HEXACHLORODIBENZOFURAN	HRGCMS	1613
57117314	2,3,4,7,8-PENTACHLORODIBENZOFURAN	HRGCMS	1613
1746016	2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN	HRGCMS	1613
51207319	2,3,7,8-TETRACHLORODIBENZOFURAN	HRGCMS	1613

17 DIOXIN ANALYTES

Appendix B

Field Measurement Test Kit Instructions and Calibration Requirements

Appendix B of the Sampling and Analysis Plan for Norwegian Star can be found in the Cruise Ship Rulemaking Record in Section 6.4, Document Control Number 00336.

Appendix C

Sampling Schedule

Pre-Sampling and Sampling Schedules
Norwegian Star

July 31 (Saturday)

- Pre-Sampling Team arrives in Seattle.

August 1 (Sunday)
Seattle, 7:00am to 4:00pm

- Board Star.
- Establish ship contacts and attend sampling kick-off meeting with ship personnel (ship superintendent, chief engineer, and staff captain). Discuss health and safety requirements and emergency procedures.
- Inspect sampling points and identify any required sampling port modifications or plumbing. Review sampling procedures with ship's crew.
- Submit shipping manifest for equipment blank planned for August 3 (Tuesday).
- Locate and load sampling equipment (ISCOs, flow meters, bottles, trip blank, and pre-sampling equipment/PPE). Check bottles for breakage or incomplete shipment.
- Locate storage and staging areas; prep and organize these areas.
- Identify and test Internet connection.
- Attend lifeboat drill.

August 2 (Monday)
Cruising Inside Passage

- Attend morning meeting with ship personnel.
- <u>SP-5: Influent to wastewater treatment</u>. Install Controlotron flow meter on influent to wastewater treatment (inlet pipe to drum filters). Begin logging data; compare to output from existing Siemens flow meter as same location for confirmation of setup. Determine how to retrieve logged Siemens flow data from the Star control system. Practice retrieving/downloading flow data.
- <u>SP-7/SP-8: Effluent from wastewater treatment</u>. Install Controlotron flow meter on effluent from wastewater treatment (new effluent line to overboard discharge port).

Begin logging data; compare output to flow data from influent to treatment. Practice retrieving/downloading flow data.

August 3 (Tuesday)
Juneau, 2:00pm to 10:00pm

- Attend morning meeting with ship personnel.

- SP-3: Accommodations wastewater characterization. Install Controlotron flow meter on outlet pipe from accommodations wastewater collection tank. Begin logging data; collect data on accommodations collection tank levels (if available) for confirmation of setup. Practice retrieving/downloading flow data.

- SP-5: Influent to wastewater treatment. Download and review flow data. Practice programming ISCO and attempt a test composite. Determine appropriate times to collect grab samples.

- SP-7/SP-8: Effluent from wastewater treatment. Download and review flow data. Practice programming ISCO and attempt a test composite. Determine appropriate times to collect grab samples.

- Determine whether measured flow data from graywater sampling points can be compared to other metrics (e.g., tank level data from Scanship control room).

- Inspect sampling points to verify required sampling port modifications or plumbing.

- Assist laboratory analysis crew member, who will board for the day and set up laboratory space.

- Collect equipment blank and send off with laboratory analysis crew member. (Samples will be shipped on Wednesday, August 4 for receipt by laboratories on Thursday, August 5.) Send email to Sample Control Center regarding sample shipment.

August 4 (Wednesday)
Skagway, 7:00am to 8:00pm

- Attend morning meeting with ship personnel.

- SP-4: Laundry wastewater characterization. Install Controlotron flow meter on piping on suction side of laundry holding tank discharge pumps. Begin logging data; collect data on laundry holding tank levels (if available) for confirmation of setup. Practice retrieving/downloading flow data.

- SP-1: Galley wastewater characterization. Install Controlotron flow meter on discharge pipe from galley wastewater holding tank. Begin logging data; collect data on galley holding tank levels (if available) for confirmation of setup. Practice retrieving/downloading flow data.

- SP-3: Accommodations wastewater characterization. Download and review flow data. Practice programming ISCO and attempt a test composite. Determine appropriate times to collect grab samples.

- SP-5: Influent to wastewater treatment. Download and review flow data and results of test composite from previous day. Revise ISCO program as needed and continue test composite. Verify appropriate times to collect grab samples.

- SP-7/SP-8: Effluent from wastewater treatment. Download and review flow data and results of test composite from previous day. Revise ISCO program as needed and continue test composite. Verify appropriate times to collect grab samples.

August 5 (Thursday)
Cruising Glacier Bay National Park

- Attend morning meeting with ship personnel.

- SP-4: Laundry wastewater characterization. Download and review flow data. Practice programming ISCO and attempt a test composite. Determine appropriate times to collect grab samples.

- SP-1: Galley wastewater characterization. Download and review flow data. Practice programming ISCO and attempt a test composite. Determine appropriate times to collect grab samples.

- SP-3: Accommodations wastewater characterization. Download and review flow data and results of test composite from previous day. Revise ISCO program as needed and continue test composite. Verify appropriate times to collect grab samples.

- SP-5: Influent to wastewater treatment. Download and review flow data and results of test composite from previous day. Revise ISCO program as needed and continue test composite, if needed.

- SP-7/SP-8: Effluent from wastewater treatment. Download and review flow data and results of test composite from previous day. Revise ISCO program as needed and continue test composite, if needed.

- Interview ship's crew to determine appropriate date, times, and collection frequency for SP-2: Food pulper wastewater characterization.

- Test sampling methodologies for collecting samples at SP-9: Dried wastewater treatment sludge and SP-10: Incinerator ash. Determine best location to collect SP-11: Source water.

August 6 (Friday)
Ketchikan, 6:00am to 1:30pm

- Attend morning meeting with ship personnel.

- SP-4: Laundry wastewater characterization. Download and review flow data and results of test composite from previous day. Revise ISCO program as needed and continue test composite. Verify appropriate times to collect grab samples.

- SP-1: Galley wastewater characterization. Download and review flow data and results of test composite from previous day. Revise ISCO program as needed and continue test composite. Verify appropriate times to collect grab samples.

- SP-3: Accommodations wastewater characterization. Download and review flow data and results of test composite from previous day. Revise ISCO program as needed and continue test composite, if needed.

- SP-5: Influent to wastewater treatment. Download and review flow data and results of test composite from previous day. Revise ISCO program as needed and continue test composite, if needed.

- SP-7/SP-8: Effluent from wastewater treatment. Download and review flow data and results of test composite from previous day. Revise ISCO program as needed and continue test composite, if needed.

- Contact Mail Boxes Etc. to discuss logistics for planned sample shipment on Friday August 13.

August 7 (Saturday)
Victoria, 6:00pm to midnight

- Attend morning meeting with ship personnel.

- SP-4: Laundry wastewater characterization. Download and review flow data and results of test composite from previous day. Revise ISCO program as needed and continue test composite, if needed.

- SP-1: Galley wastewater characterization. Download and review flow data and results of test composite from previous day. Revise ISCO program as needed and continue test composite, if needed.

- SP-3: Accommodations wastewater characterization. Download and review flow data and results of test composite from previous day. Revise ISCO program as needed and continue test composite, if needed.

- <u>SP-5: Influent to wastewater treatment</u>. Download and review flow data and results of test composite from previous day. Revise ISCO program as needed and continue test composite, if needed.

- <u>SP-7/SP-8: Effluent from wastewater treatment</u>. Download and review flow data and results of test composite from previous day. Revise ISCO program as needed and continue test composite, if needed.

- Submit planned shipping manifests for sampling week.

- Sampling Team arrives in Seattle.

August 8 (Sunday)
Seattle, 7:00am to 4:00pm
Sampling Day 1

- Sampling Team and laboratory analysis crew member board ship at 9:00am. Attend sampling kick-off meeting with ship personnel.

- Collect samples according to Sampling Schedule table for Norwegian Star.

- Laboratory analysis crew member analyzes all microbiological grabs.

- Monitor flow meters and download/retrieve flow data and tank level data.

- Conduct field tests after each grab.

- Any revisions to shipping manifests?

- Complete data sheets.

August 9 (Monday)
Cruising Inside Passage
Sampling Day 2

- Attend morning meeting with ship personnel.

- Collect samples according to Sampling Schedule table for Norwegian Star.

- Laboratory analysis crew member analyzes all microbiological grabs, sets up Day 1 BOD5, and analyzes Settleable Solids samples.

- Prepare Day 1 samples for shipment from Juneau on August 10 (Tuesday).

- Monitor flow meters and download/retrieve flow data and tank level data.

- Conduct field tests after each grab.
- Any revisions to shipping manifests?
- Complete data sheets

August 10 (Tuesday)
Juneau, 2:00pm to 10:00pm
Sampling Day 3

- Attend morning meeting with ship personnel.
- Collect samples according to Sampling Schedule table for Norwegian Star.
- Laboratory analysis crew member analyzes all microbiological grabs and prepares Day 1 BOD_5 samples for transfer to Juneau laboratory. Transfer Day 2 BOD_5 samples to Juneau laboratory.
- Prepare Day 1 and Day 2 samples for shipment by FedEx from Juneau. (Samples will be shipped on Wednesday, August 11 for receipt by laboratories on Thursday, August 12.) Send email regarding sample shipment.
- Monitor flow meters and download/retrieve flow data and tank level data.
- Conduct field tests after each grab.
- Any revisions to shipping manifests?
- Complete data sheets.

August 11 (Wednesday)
Skagway, 7:00am to 8:00pm
Sampling Day 4

- Attend morning meeting with ship personnel.
- Collect samples according to Sampling Schedule table for Norwegian Star.
- Laboratory analysis crew member analyzes all microbiological grabs.
- Prepare and ship Day 3 samples to Analytical laboratory in Juneau via Skagway Air. Escort sample shipment to airport to verify shipment by Skagway Air.
- Laboratory contractor in Juneau retains Day 3 BOD_5 samples for analysis and maintains all other Day 3 samples on ice.

- Monitor flow meters and download/retrieve flow data and tank level data.
- Conduct field tests after each grab.
- Any revisions to shipping manifests?
- Complete data sheets.

August 12 (Thursday)
Cruising Glacier Bay National Park
Sampling Day 5

- Attend morning meeting with ship personnel.
- Collect samples according to Sampling Schedule table for Norwegian Star.
- Laboratory analysis crew member analyzes all microbiological grabs.
- Laboratory contractor in Juneau ships Day 3 samples on Thursday, August 12 via FedEx for receipt by laboratories on Friday, August 13.) Send email regarding sample shipment.
- Prepare Day 4 samples for shipment from Ketchikan on August 13 (Friday).
- Monitor flow meters and download/retrieve flow data and tank level data.
- Conduct field tests after each grab.
- Any revisions to shipping manifests?
- Complete data sheets.

August 13 (Friday)
Ketchikan, 6:00am to 1:30pm
Sampling Ends

- Attend morning meeting with ship personnel.
- Prepare Day 4 and Day 5 samples for shipment by FedEx from Ketchikan or by Alaska Goldstreak from Ketchikan (BOD_5 samples only). (Samples will be shipped on Friday, August 13 for receipt by laboratories on Saturday, August 14, except for BOD_5 samples, which will be received at one of the contractor's Juneau laboratory on Friday, August 13.) Send email regarding sample shipment.
- Laboratory analysis crew member analyzes all microbiological grabs.

- Monitor flow meters and download/retrieve flow data and tank level data.
- Remove flow meters, and pack equipment for shipment from Seattle.
- Any revisions to shipping manifests?
- Complete data sheets.

August 14 (Saturday)
Victoria, 6:00pm to midnight

- Attend morning meeting with ship personnel for post-sampling debriefing.
- Laboratory analysis crew member analyzes all microbiological grabs.
- Post-sampling debriefing meeting with sampling crew.
- Complete data sheets.

August 15 (Sunday)
Seattle, 7:00am to 4:00pm

- Offload sampling equipment to Seattle cruise agent for shipping from Seattle to Chantilly on Monday, August 16.
- Sampling crew disembarks.

Sampling Schedule for Norwegian Star (8/8 to 8/12)

Sample Point	Day 1 Sunday 8/8/04 Seattle, WA Depart 1600	Day 2 Monday 8/9/04 At Sea	Day 3 Tuesday 8/10/04 Juneau, AK Arrive 1400 (anchor)	Day 4 Wednesday 8/11/04 Skagway, AK Arrive 0700	Day 5 Thursday 8/12/04 At Sea
SP-1 Galley Wastewater Characterization	Grabs: Micros (2x) VOC HEMs Cyanide Composites: SVOCs Metals BOD Solids Group I Group II Total Volume: 10.5 L	Grabs: Micros (2x) VOC HEMs Cyanide Composites: SVOCs Metals BOD Solids Group I Group II Pesticides Total Volume: 10.5 L	Grabs: Micros (2x) VOC HEMs Cyanide Composites: SVOCs Metals BOD Solids Group I Group II Total Volume: 8.5 L	Grabs: Micros (2x) VOC HEMs Cyanide Composites: SVOCs Metals BOD Solids Group I Group II Total Volume: 8.5 L	Grabs: Micros (2x) VOC HEMs Cyanide Composites: SVOCs Metals BOD Solids Group I Group II Total Volume: 8.5 L
SP-2 Food Pulper Wastewater Characterization			Grabs: Micros (3x) VOC HEMs Cyanide Composites: SVOCs Metals BOD Solids Group I Group II Total Volume: 8.5 L		

Sampling Schedule for Norwegian Star (8/8 to 8/12) (Continued)

Sample Point	Day 1 Sunday 8/8/04 Seattle, WA Depart 1600	Day 2 Monday 8/9/04 At Sea	Day 3 Tuesday 8/10/04 Juneau, AK Arrive 1400 (anchor)	Day 4 Wednesday 8/11/04 Skagway, AK Arrive 0700	Day 5 Thursday 8/12/04 At Sea
SP-3 Accommodations Wastewater Characterization	Grabs: Micros (2x) VOC HEMs Cyanide Composites: SVOCs Metals BOD Solids Group I Group II Total Volume: 8.5 L	Grabs: Micros (2x) VOC HEMs Cyanide Composites: SVOCs Metals BOD Solids Group I Group II Total Volume: 8.5 L	Grabs: Micros (2x) VOC HEMs Cyanide Composites: SVOCs Metals BOD Solids Group I Group II Total Volume: 8.5 L	Grabs: Micros (2x) VOC HEMs Cyanide Composites: SVOCs Metals BOD Solids Group I Group II Total Volume: 8.5 L	Grabs: Micros (2x) VOC HEMs Cyanide Composites: SVOCs Metals BOD Solids Group I Group II Total Volume: 8.5 L
SP-4 Laundry Wastewater Characterization	Grabs: Micros (2x) VOC HEMs Cyanide Composites: SVOCs Metals BOD Solids Group I Group II D/F Total Volume: 10.5 L	Grabs: Micros (2x) VOC HEMs Cyanide Composites: SVOCs Metals BOD Solids Group I Group II Total Volume: 8.5 L	Grabs: Micros (2x) VOC HEMs Cyanide Composites: SVOCs Metals BOD Solids Group I Group II Total Volume: 8.5 L	Grabs: Micros (2x) VOC HEMs Cyanide Composites: SVOCs Metals BOD Solids Group I Group II Total Volume: 8.5 L	Grabs: Micros (2x) VOC HEMs Cyanide Composites: SVOCs Metals BOD Solids Group I Group II Total Volume: 8.5 L

Sampling Schedule for Norwegian Star (8/8 to 8/12) (Continued)

Sample Point	Day 1 Sunday 8/8/04 Seattle, WA Depart 1600	Day 2 Monday 8/9/04 At Sea	Day 3 Tuesday 8/10/04 Juneau, AK Arrive 1400 (anchor)	Day 4 Wednesday 8/11/04 Skagway, AK Arrive 0700	Day 5 Thursday 8/12/04 At Sea
SP-5 Influent to Wastewater Treatment System	Grabs: Micros (3x) VOC HEMs Cyanide Composites: SVOCs Metals BOD Solids Group I Group II PCBs Total Volume: 12.5 L	Grabs: Micros (3x) VOC HEMs Cyanide Composites: SVOCs Metals BOD Solids Group I Group II Pesticides Total Volume: 10.5 L	Grabs: Micros (3x) VOC HEMs Cyanide Composites: SVOCs Metals BOD Solids Group I Group II Total Volume: 8.5 L	Grabs: Micros (3x) VOC HEMs Cyanide Composites: SVOCs Metals BOD Solids Group I Group II Total Volume: 8.5 L	Grabs: Micros (3x) VOC HEMs Cyanide Composites: SVOCs Metals BOD Solids Group I Group II Total Volume: 8.5 L
SP-6 Influent To UV Disinfection	Grabs: Micros (3x)	Grabs: Micros (3x)	Grabs: Micros (3x)	Grabs: Micros (3x)	Grabs: Micros (3x)

Sampling Schedule for Norwegian Star (8/8 to 8/12) (Continued)

Sample Point	Day 1 Sunday 8/8/04 Seattle, WA Depart 1600	Day 2 Monday 8/9/04 At Sea	Day 3 Tuesday 8/10/04 Juneau, AK Arrive 1400 (anchor)	Day 4 Wednesday 8/11/04 Skagway, AK Arrive 0700	Day 5 Thursday 8/12/04 At Sea
SP-7 Effluent From Wastewater Treatment System	Grabs: Micros (3x) (1 lab&1 field Dup) VOC HEMs (MS/MSD) Cyanide Composites: SVOCs Metals BOD Solids Group I Group II Total Volume: 8.5 L	Grabs: Micros (3x) (1 lab&1 field Dup) VOC HEMs (MS/MSD) Cyanide Composites: SVOCs Metals BOD Solids Group I Group II Total Volume: 8.5 L	Grabs: Micros (3x) (1 lab&1 field Dup) VOC HEMs (MS/MSD) Cyanide Composites: SVOCs Metals BOD Solids Group I Group II Total Volume: 8.5 L	Grabs: Micros (3x) (1 lab&1 field Dup) VOC HEMs Cyanide Composites: SVOCs Metals BOD Solids Group I Group II Total Volume: 8.5 L	Grabs: Micros (3x) VOC HEMs Cyanide Composites: SVOCs Metals BOD Solids Group I Group II Total Volume: 8.5 L
SP-8 Effluent From Wastewater Treatment System (duplicate)	Grabs: Micros (1x) VOC (MS/MSD) Cyanide (MS/MSD) Composites: SVOC (MS/MSD) Metals (MS/MSD) BOD Solids Total Volume: 12.5 L	Grabs: Micros (1x) VOC (MS/MSD) Cyanide (MS/MSD) Composites: SVOC (MS/MSD) Metals (MS/MSD) BOD Solids Total Volume: 12.5 L	Grabs: Micros (1x) VOC (MS/MSD) Cyanide (MS/MSD) Composites: SVOC (MS/MSD) Group I (MS/MSD) Group II (MS/MSD) Total Volume: 13.5 L	Grabs: Micros (1x) Composites: Group I (MS/MSD) Group II (MS/MSD) Metals (MS/MSD) Total Volume: 12 L	Grabs: Composites: Group I (MS/MSD) Group II (MS/MSD) BOD Solids Total Volume: 9.5 L

Sampling Schedule for Norwegian Star (8/8 to 8/12) (Continued)

Sample Point	Day 1 Sunday 8/8/04 Seattle, WA Depart 1600	Day 2 Monday 8/9/04 At Sea	Day 3 Tuesday 8/10/04 Juneau, AK Arrive 1400 (anchor)	Day 4 Wednesday 8/11/04 Skagway, AK Arrive 0700	Day 5 Thursday 8/12/04 At Sea
SP-9 Dried Wastewater Treatment Sludge	Grabs: VOC SVOC Total Metals Cyanide Group I Group II Note: Revise preservation to 4 Deg C for all analytes				
SP-10 Incinerator Ash	Grabs: SVOC Total Metals D/F				
SP-11 Source Water		Grabs: (1x) Micros VOC SVOC Metals Cyanide BOD Solids Group I Group II			
SP-12 Trip Blank	Grabs: VOC				

Sampling Schedule for Norwegian Star (8/8 to 8/12) (Continued)

Sample Point	Day 1 Sunday 8/8/04 Seattle, WA Depart 1600	Day 2 Monday 8/9/04 At Sea	Day 3 Tuesday 8/10/04 Juneau, AK Arrive 1400 (anchor)	Day 4 Wednesday 8/11/04 Skagway, AK Arrive 0700	Day 5 Thursday 8/12/04 At Sea
SP-13 Equipment Blank	Grabs: SVOC Total Metals Dissolved Metals Total Volume: 4 L				
Shipping Schedule			Via Fed Ex 7 organics 2 Available CN 1 Pesticides 13 classicals/metals 1 D/F&PCBs (international) Total: 24 coolers 2 coolers to lab contractor	Via Skagway Air 1 BOD 6 classicals/metals 1 available CN 3 organics Total: 11 coolers	**Friday 8/13/04** **Ketchikan, 0600** Via Fed Ex 4 Organics 1 Available CN 11 classicals/metals Total: 16 coolers Via Gold Streak 12 BOD
					Sunday 8/15/04 Seattle, WA Via Fed Ex Sampling equipment

Notes:

BOD shipping: BODs from day 1and 2 hand off to one of the laboratory contractors in Juneau.
BODs from day 3 ship from Skagway (via Skagway) to one of the laboratory contractors.
BODs from day 4 and 5 ship from Ketchikan (via Gold Streak, need early flight for same day deliver) to one of the laboratory contractors.